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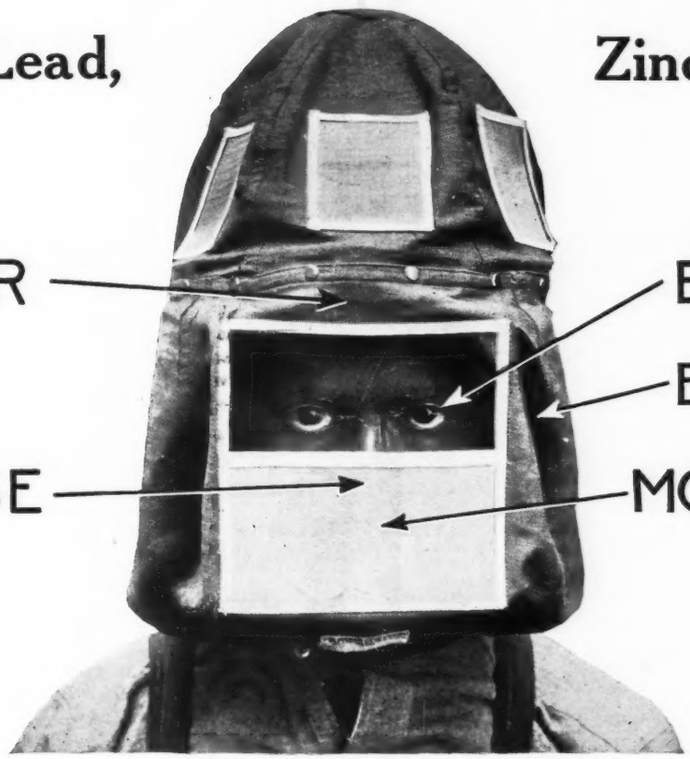

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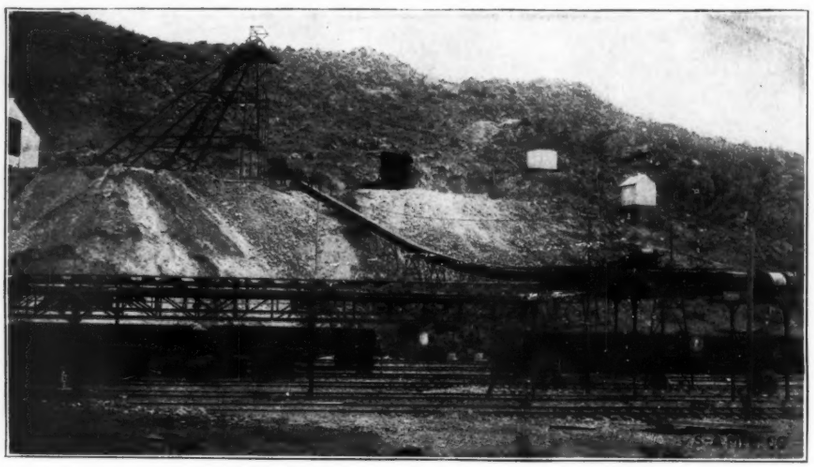

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Engineering and Mining Journal

VOLUME 102 JULY 15, 1916 NUMBER 3

The Yellow Pine District, Nev.

By Leroy A. Palmer*

SYNOPSIS—The mining district about Goodsprings, Nev., was discovered in 1860 and produced lead ore. Gold and copper were found also. Zinc ore, the camp's mainstay now, was not recognized until 1906. The camp is gradually increasing in importance, and production is growing. Its features are discussed.

Toward the close of 1914 the Yellow Pine mining district, in the vicinity of Goodsprings, Nev., was working about 40 men, and its future appeared decidedly uncertain. Due to the extraordinary rise in the prices of lead and zinc, the principal products of the camp, 1916 opened with about 20 mines in operation and 400 men employed, with a monthly payroll of $45,000 and a monthly output approximating $400,000.

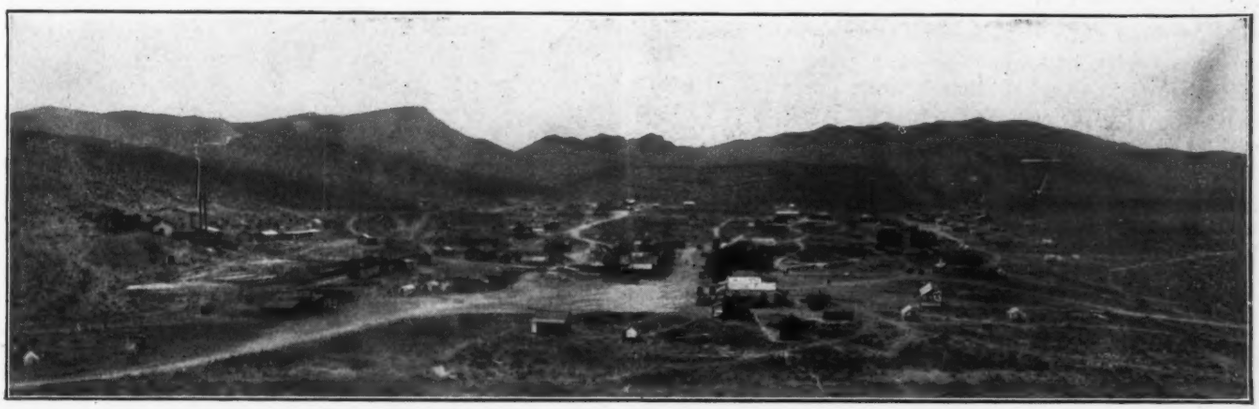
The first mining in this locality was at the Potosi, now the second largest producer of the district, which was discovered in 1860 by Mormon prospectors. This property produced rich lead ore that was mined by the Mormons and used by them in the manufacture of the bullets necessary in the border warfare of pioneer days.

Some gold and copper ores were found also, and gold and silver were associated with the copper and lead. So for years the district was a small but steady producer of these four metals, but the most momentous event of its history did not occur until 1906. Associated with the lead ores was a heavy gray-white material of unknown composition, considered worthless and commonly referred to as country rock. The credit of identifying this "country rock" as zinc ore seems to belong to Connie Brown, an engineer, who observed it while making a professional visit to the camp. These pages of the camp's history remind one of the awakening at Leadville, or the recognition of the "black iron" that was the source of much profanity among the ranches of what is now the Boulder tungsten district.

The district is about 15 mi. long and from 10 to 12 wide, toward the southern end of the Spring Mountain range and near the Nevada-California line. Goodsprings, the only town, is reached by an 8-mi. auto ride over good roads from Jean, Nev., on the Salt Lake route. The gold which, aside from that associated with the copper ores, once formed an important part of the production of the district, is found in altered igneous rocks, but no gold is produced now except as a byproduct.

The zinc-lead ores occur as replacement and fissure deposits in upper Carboniferous limestone. The two kinds of ore occur in the same orebodies, but usually with a fairly clear line of demarcation, so that it is frequently possible to mine a practically clean high-grade product that needs no milling before being shipped to the smelter. The country has been subjected to fracturing and complex folding. The ores are found through a vertical range of 3,000 ft. in close proximity to the fractures and folds. The eastern limit of the ore zone is a prominent fault that passes nearly through the town of Goodsprings. This fault shows particularly well just northwest of town, where the displacement has been estimated at 4,000 ft. and the red Permian sandstone can be seen at a geographic level several hundred feet lower than the white Pennsylvanian limestones.

At some pre-Tertiary time the limestones were intruded by quartz monzonite that is found as large irregular



THE TOWN OF GOODSPRINGS, CENTER OF THE YELLOW PINE MINING DISTRICT

*Mining engineer, San Francisco, Calif.

masses and sills which are cut by crossdikes of a similar material. Overlying the other rocks is a series of Tertiary basalt and andesite flows. The flows bear no relation to the orebodies of the district; in fact, with the exception of those of the Yellow Pine, these are not associated with any of the igneous rocks. In this mine the ores are found both in fissures and as replacements from 40 to 50 ft. from the intrusives. In no other mine of the district, however, is there any apparent connection between the orebodies and the igneous rocks.

While the lead and zinc mines are the mainstay of the district, there are two other deposits of interest and doubtless of future importance. One of these is the Boss, which presents an interesting study to the geologist and mineralogist. The commercial products of this mine are gold, silver, copper and platinum, but many of the rarer metals are found in small quantities. The copper occurs in the form of chalcocite, bornite, malachite and azurite. The platinum is presumably covellite. The ore is a replacement in the limestone in a mineralized zone proved to be 190 ft. wide, with lenses up to 28 ft. in width, the deposits occurring across the bedding planes. One such lens being developed at the time these notes were made showed a length of 265 ft., a width of 12 ft. and a depth of 112 ft., with neither top nor bottom in sight. An average of one orebody, estimated to contain 11,000 to 15,000 tons, is 6% copper, 1 oz. platinum and $12 gold per ton. Other assays, not of picked samples, but of considerable bodies, have been 12% copper, 1½ oz. platinum, 3 oz. silver and $0.10 gold and 1½ to 2% copper with 4 to 5 oz. each of gold and platinum.

Another deposit out of the ordinary for this district is at the Lavena mine, between Goodsprings and the Yellow Pine mine. The Lavena is on a dike of monzonite porphyry 250 ft. wide, similar to that of the Bingham copper deposits, throughout which are veinlets of quartz carrying pyrite, chalcopyrite and gold. One 2-ft. vein in the porphyry gives assays of 2 to 4% copper, 8 oz. silver and $2.80 to $10 gold. Development on this property is limited as yet, but at the lower levels there seems to be a general dissemination of the copper through the porphyry with the possibility of their being developed into a large body of low-grade ore.

Systems of Mining Employed

Various systems of mining are in vogue in the district. The deposits are worked by vertical and inclined shafts, tunnels and opencuts. Some of the companies, such as the Yellow Pine, that have demonstrated the existence of bodies of ore of considerable size, have sunk comparatively deep shafts and are blocking out ore ahead. Others are following the method in general use in the eastern zinc districts, of making only a temporary opening and following the orebody through its various meanderings.

The Yellow Pine, the largest mine of the district, is square-setting. The lime walls are hard, but their general nature is such that the management considers this system best adapted to them. The mine is opened by an incline, on an angle of 35° to 40°, to a depth of 930 ft. on the slope. Levels are driven every 100 ft. The fissure deposits have an average strike of N 30° W with easterly dip, and the bedded deposits strike nearly due north with westerly dip. Some of the stopes attain considerable size —up to 100 ft. in width and 300 to 400 ft. in length. While it has been considered advisable to support these stopes by means of square sets, light timbers only are required, 6x8's and 8x8's being commonly used. After a stope is worked out, the timbers are drawn and it is filled with waste.

The mine is connected with the mill at Goodsprings and with the Salt Lake route at Jean by a narrow-gage railroad operating a Shay and a gasoline locomotive. The Boss has opened up by means of tunnels, five of which have been driven or are in course of construction. The lowest will reach the vein at a vertical distance of 550 ft. The Boss uses no timber at all in stoping. The narrower deposits are worked without support, as the walls will stand while the ore is being removed. The larger deposits are worked by underground glory-holing.

The Sultan, next to the Yellow Pine the largest producer of the district proper, is working two glory holes by a typical milling system. One tunnel has been run in to a point 60 ft. below the surface and a raise driven to the orebody, which at the time these notes were made had been worked from the surface 100x20x30 ft. The other tunnel is connected by a 175-ft. raise to a glory hole 50x60x40 ft.

At the Anchor a short tunnel has been driven in and a shaft and winze sunk to 450 ft. below the surface. The ore is in a replacement on an average dip of 38° and a maximum width of 32 ft. It is mined by a typical overhead stoping system, stulls alone being used to support the walls.

OPEN CUT AT MONTE CRISTO MINE

Many "gopher" methods are employed. At the Monte Cristo, leasers are taking out a high-grade, 37% zinc ore carrying less than 1% lead, by means of the opencut shown in the illustration.

About a mile up the cañon from the Monte Cristo and well up the mountainside, where a wagon road is hardly to be considered, is the Barnes, Hickman & Flesher lease on the Palace and Porter group, belonging to the Yellow Pine. This lease is following several bunches of high-grade zinc ore by means of short tunnels and opencuts. Shipments to the loading platform at the Monto Cristo is by means of burro train.

The lime, in which practically all of the development work is carried on, does not make for high costs. Among the companies operating systematically there is uniformity in the cost of the various kinds of development. Even at the larger mines much handwork is done, especially in the stopes. The Yellow Pine sank its main two-compart-

ment shaft 5½x9½ ft. in the clear, the last lift of 116 ft. at a cost of $20 per ft., including timber. At the Anchor its single-compartment shaft, 5x7 ft., was sunk 200 ft. from the first tunnel level for $11 per ft. The Yellow Pine was sunk with two shifts, one drilling and one mucking. Progress varied considerably, from 30 to 75 ft. per month. The work was done both by hand and with 3¼-in. piston machines, 9 to 16 holes constituting a round. At this mine the drifts are an average of 4x7 ft. in cross-section and have been driven both by hand and with Temple-Ingersoll air-electric drills. Four to 16 holes are used to a round, and as high as 9 ft. has been broken with a round of four holes. This, of course, is unusual. Drifting costs at the Yellow Pine are $5 to $5.50 per ft., a fair average for the entire district, in which they run from $4.50 to $6.50.

With the exception of the Yellow Pine, costs of stoping and timbering are not available. These are $3.15 and $0.29 per ton respectively. It is probable that the other mines of the district are accomplishing this work at a lower figure, since the Yellow Pine is the only one in which it is necessary to resort to square-setting the entire deposit.

Milling Methods Adopted

The milling of the ores of the Goodsprings district presents an interesting variety of practice. The Yellow Pine has the only wet mill hereabouts, and it is probable that dry milling is more extensively applied here than in any other locality. Most of the mills are not concentrators, strictly speaking, but are separators, which separate one class of ore from another, making a variety of products, all of which are shipped and none rejected.

The Yellow Pine mill, which has a capacity of 100 tons per 24 hr. does not differ markedly from any other ore-dressing mill. The ore is fed over a grizzly to a jaw crusher, thence to rolls, impact screens, jigs and tables. Three products are made—lead concentrates, zinc concentrates and zinc slimes. The first two are trammed direct from the mill to the narrow-gage cars, but the slimes are settled in ponds before being shipped. The accompanying table gives an idea of the result of this system of treatment.

RESULTS OF TREATMENT OF ORES

Class	Pb, %	Zn, %	Ag, Oz.
Mill head	10.2	31.8	5.4
Lead concentrates	53.2	13.75	28.1
Zinc concentrates	4.4	33.2	2.5
Zinc slime	7.3	35.1	4.0

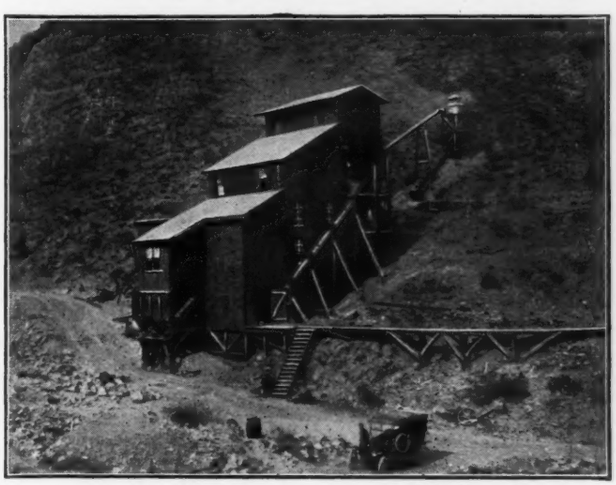
Milling costs during 1915 were $1.46 per ton. Two general systems of dry treatment are in vogue, the Plumb jig and the Stebbins table—both doing satisfactory work. The usual practice is to put the ore through a crusher and rolls, thence to impact screens or trommels, which return the oversize to the rolls and send the undersize to the concentrator. The various products are removed by screws or belts or by tramming. All machinery is kept tightly housed, and suction fans are used to draw off the dust; but, as has always been the case with the dry mills, the best that can be done in that respect is to alleviate the unpleasant condition to some extent.

The dry mills are mostly of limited capacity and have been in operation but a comparatively short time, so there is not much definite data as to their operation. One of them, the Anchor, using a Stebbins table, takes heads carrying 24% zinc and 35% lead and makes 34% zinc and 67% lead concentrates. The zinc concentrates carry 6% lead, but the lead concentrates are practically clean. The mill dust will average about the same as the heads.

The work described is on the separation of a lead-zinc ore in which no rejection is made. In treating a straight lead ore, tailings are rejected and disposed of by tramming. A saving of 65% is effected, 35% going into the tailings and dust, mostly the latter, from which it is hoped to recover it.

About 20 mines in the district are making a gross output of 6,000 tons a month, the average at present prices being about $65 a ton in lead and zinc. The Yellow Pine is the largest shipper. During 1915, with the mill out of commission for two months during which time only crude zinc ore was shipped, this company mined 18,400 tons. About 15% was shipped crude and the remainder milled. Gross receipts were $850,000, of which $700,000 was profit.

Next to the Yellow Pine the largest producer is the Potosí, which is employing 60 men and shipping 1,200



THE ANCHOR DRY-CONCENTRATING MILL

tons of crude zinc ore per month, although this mine is not considered within the Yellow Pine district proper.

Next to the Potosí is the Sultan, working 35 men and producing 360 tons per month. This mine is of interest in that it was opened only a year ago, commencing operations with three men, and has always paid its own way.

The other mines have still smaller outputs, some of the leases shipping a car or less a month. As an example of what some of the smaller mines are doing, the Bullion might be cited. This company is shipping monthly about 120 tons of lead concentrates carrying 62% lead and 6 oz. silver; 35 tons crude lead assaying 70% and 30 tons crude zinc assaying 38%. While the tonnage is not high, such values, coupled with the present high prices of the metals, make the output mount up in worth.

There seems to be plenty of ore in sight in the district. Mining and treatment conditions are not unfavorable, so it is reasonable to expect that the district will continue to produce while its metals command a fair price on the market.

Protected Thermoelements are discussed by Arthur W. Gray, in scientific paper No. 276 of the U. S. Bureau of Standards. It is pointed out that usually the wires of thermoelements are either entirely unprotected or else merely have portions adjacent to the junctions in glass or porcelain tubes. Believing that this is insufficient, Mr. Gray describes a type of mounting developed and used by the Bureau of Standards.

Tungsten-Molybdenum Ore Concentration*

An examination of ore from Callie Soak, Poona, Murchison Goldfields, of Western Australia, showed that it consisted of a mixture of molybdenite, scheelite and a smaller amount of wolframite in a gangue of quartz, mica and kaolin. The ore was too close-grained for hand sorting, although other portions of the lode might be suitable for grading in this way. An analysis of the ore showed 2.02% molybdenite and 9.07% tungstic oxide. The mineral composition was approximately 2% molybdenite, 10% scheelite, 1½% wolframite and 86½% gangue.

For marketing, concentrates should run at least 90% molybdenite in the case of molydenum ores and for tungsten ores, at least 60% tungstic oxide. Since all the minerals are heavier than quartz and the other gangue, water concentration appears reasonable. Molybdenite, however, has the property of floating on water, and this prevents successful gravity concentration, since it is almost impossible to overcome completely this floating effect. An attempt was made to concentrate the molybdenite by gravity, but it was a failure. Scheelite and molybdenite are extremely fragile, particularly when in the granular condition, and considerable loss is to be expected by sliming. The method of operation finally decided upon was first to remove the molybedenite by flotation, then to obtain the scheelite and wolframite from the residue by gravity concentration.

Series of Experiments Carried Out

Two series of experiments were carried out, one on a portion crushed to pass an 80-mesh screen, the other on a portion crushed to pass 30-mesh. Satisfactory results were obtained only from the latter, as may be seen by Table 1.

Of the 80-mesh sample, a great deal was much finer. A 100-gram sample was taken and the ore sprinkled on the surface of water in small quantities. The molybdenite-bearing scum was decanted through a filter, the residue stirred briskly, and the extra molybdenite brought to the surface by this means was also filtered off. Total concentrates weighed 1.71 grams and assayed as shown in the table. This material is unprofitable on account of not only the low grade of concentrates, but also poor extraction. No oil was used in these tests, and this may in part account for the poor extraction. At the same time the large amount of clayey slime present reduces the molybdenite value of the concentrates by simple adulteration. It seems also to give a poor extraction by incasing the molybdenite particles with fine dust, thus fouling or clogging them and preventing them from floating freely. The residue, after the removal of molybdenite, was panned down in the usual way to obtain the tungsten. There was again a good deal of sliming, and much of the scheelite was lost in this way. The weight of concentrates was 12.9 grams and assayed as shown. Here, too, both the grade and recovery are unsatisfactory, a result largely due to the overgrinding of the ore.

TABLE 1. TESTS ON 80- AND 30-MESH CRUSHING

Size of Ore	Kind of Concentrates	Weight of Concentrates of Ore	Assay Value	Recovery on Original Ore
80-mesh.....	Molybdenum	1.71%	37.8%MoS_2	31.9%
	Tungsten	12.9 %	36.3%WO_3	51.7%
	Molybdenum crude	6.01%	20.8%MoS_2	61.9%
	Molybdenum refloated	1.01% (A)	75.0%MoS_2	37.5%
30-mesh.....	Molybdenum treatedon 90-mesh screen	0.87% (B)	92.9%MoS_2	39.8%
	Tungsten	12.60%	57.5%WO_3	79.9%

Of the 30-mesh material, much of it was ground too much—half of it would pass a 60-mesh screen. This lack of uniformity in the crushed product is undesirable, and it is believed that with more uniform crushing even better results could have been secured. Owing to the diversity and hardness of the ingredient minerals, more than ordinary care is required in crushing ore of the kind. This extra care will be more than paid for in the greater effectiveness of the subsequent treatment and the ensuing higher grade of extraction. The crushing plant should not be fed with excessive quantities of ore at one time, for if it is, overcrushing will surely result. Every endeavor should be made to obtain uniformity in size of ore particles, in this case between 30- and 40-mesh. Some sliming is of course unavoidable, but it can be reduced to a very small amount.

In testing, 100 grams of the sample were taken, as before, and the molybdenite removed first. This time the effect of oil and acid were investigated in addition to simple flotation on water. The separation was carried on in three stages. First, using water flotation alone, the ore was sprinkled on the surface and the scum decanted off. Vigorous stirring and blowing of air through the pulp caused very little more sulphide to rise. Oil was then added in different proportions, from 1 in 10,000 to 1 in 1,000, the whole being vigorously agitated in a closed vessel with each addition. The amount of scum formed each time was noted, and when the proportion of oil added had reached the latter figure, it was found to be sufficient. Further addition of oil did not extract any more molybdenite. The total scums from oil flotation were set aside. Possibly with a richer ore more oil would have been required, the amount being determined by experiment. The oil used was the ordinary commercial phellandrene, obtained from the eucalyptus tree.

Results of Acid and Oil Treatment

An acid treatment was then combined with the oil, and the ore residue was shaken vigorously with oily water, 1 in 1,000, and varying amounts of sulphuric acid were added in proportions of 1 in 10,000 to 1 in 1,000. The use of acid is not warranted, because as will be seen from Table 2, the additional recovery of sulphide is so small. The acid did no harm, but was unnecessary so long as air was carried into the pulp by agitation or blowing. The weights of various extracts were as shown in Table 2.

TABLE 2. WEIGHT OF CONCENTRATES RECOVERED

Treatment:	Weight of Concentrates, Grams
Water alone	2.785
Water and oil	2.948
Water, oil and acid	0.276
Total	6.009

Each concentrate contained a good deal of slime in addition to molybdenite, but as the aim was primarily to obtain high recovery, even at the risk of producing lower-grade concentrates, it was found impossible to avoid this. The assay results, as already given, was 20.8% of molybdenite, equal to an extraction of 61% of the total molybdenite in the ore. This recovery was rather disappointing,

*Abstract of an article by A. J. Robertson, in Bulletin No. 64 of the Geological Survey of Western Australia.

but was the best obtainable, although too low for market as it stood. About 79% of slimy gangue constituted the valueless portion. Two methods were then adopted to improve the result: First, an additional water-oil flotation and agitation and, second, a simple screening through a 90-mesh screen, rejecting the portion passing through. The latter gave best results. Recovery was slightly higher and the grade much better with sizing than with the flotation treatment, though in both cases the actual percentage of recovery was low. Its simplicity makes the second method of increased value, and it will be observed that it is only about 6% of the ore crushed that would need screening. Since screening operations are troublesome, the smaller the quantity of material to be dealt with in this way the better. The results of these two tests are included in Table 3. For every ton of ore treated by flotation and followed by sizing of concentrates, about 181 lb. of high-grade molybdenite concentrates would be produced.

It is not possible to get high-grade molybdenite concentrates by a single treatment. Slime is always formed in some amounts and will always collect with the molybdenite, either from suspension in the water or by actual floating on the surface film. The effect of slimes on concentrate grades was brought home more forcibly by the following experiments: A sample of crushed ore, at 30-mesh, was sized into three portions and the molybdenite in each lot was floated off by water alone and collected. The results, almost self-explanatory, are shown in Table 3. Here it is obvious that there is one advantage of preliminary sizing. It entails better recoveries in each case

TABLE 3. EFFECT OF SLIMES ON CONCENTRATE GRADE

	Sized Portion, Grams	Recovery	Grade of Concentrates
30-90 mesh	62.3	Good	About 70% MoS_2
90-150 mesh	10.7	Good	About 40% MoS_2
150 and finer	26.5	Good	About 5% MoS_2
Loss dust	0.5	80-90%	.....
Ore taken	100.0		

TABLE 4. DISTRIBUTION OF VALUES

Per Ton of Ore:	Molybdenum £ s d	Tungsten £ s d	Total £ s d
In ore	10 0 0	13 10 0	23 10 0
In concentrates	4 0 0	10 16 0	14 16 0
In tailings	6 0 0	2 14 0	8 14 0

than obtained by direct treatment of the unsized ore.

It is also to be noted that the grade of concentrates falls off as the fineness increases. Since it would not pay to size the ore in a treatment plant in this way, the aim should be to crush to uniform size (30-mesh found most suitable) avoiding sliming by careful crushing.

Means of Recovering the Tungsten

For the recovery of tungsten the remainder of the 30-mesh sample left after removal of molybdenite was concentrated by panning. Concentrates free from slimes and weighing 12.6 grams were easily obtained. As both assay value and percentage recovery indicate, it can be taken as satisfactory. A great part of the loss is attributable to overcrushing. Every ton of ore treated would yield about 270 lb. of tungsten concentrates, running about 60% tungstic oxide (WO_3). The complete distribution of values indicated by the experiments on ores crushed to pass a 30-mesh screen are therefore as shown in Table 4. These results have been obtained by flotation of the molybdenite with oil at atmospheric pressure and simple gravity concentration of the scheelite and wolframite. The recovery of the latter presents no difficulties and should be carried out successfully on ordinary concentration tables, provided care be taken to avoid grinding the more fragile scheelite into slime.

Two other methods are in use for the concentration of molybdenum ores—flotation without oil at atmospheric pressure and flotation with oil under partial vacuum (the Elmore process). The former has proved successful in Queensland, while the latter is claimed to have yielded extractions of 90% on Norwegian ores.

Since the ore is worth only £4 per ton for molybdenite as against £11 for tungsten, it would probably not be worth while making an elaborate treatment for the recovery of molybdenite. The more economic process would be to treat it directly for its tungsten content and catch the chance molybdenum that comes off without making any extensive provision for doing it. Should it be possible to crush without making so much slime, a better recovery of molybdenite would be obtained and would prove a payable proposition.

Manganese Ore in 1915

Manganese ore production in the United States in 1915, as reported by the United States Geological Survey, was 9,651 long tons, the largest since 1901 and more than three times the production in 1914, which was 2,635 tons. This output was made by 34 operators in 10 states, of which the four most important, in order of output, were Georgia, California, Virginia and Arkansas. In addition, Alabama, Arizona, Colorado, Tennessee, Texas and Utah produced small amounts of ore. The imports of manganese ore for 1915 were 313,985 tons, compared with 283,294 tons for 1914. Of the ore imported in 1915, 268,786 tons, or 85% of the total, came from Brazil—more than twice the quantity received from that country in any preceding year. The imports from India were 36,450 tons, or about one-fourth the average of the preceding 10 years. No ore was received from Russia.

The production of manganiferous iron and silver ores for 1915 was 798,404 tons, which was almost twice the output in 1914.

The shortage of high-grade manganese dioxide ores caused by cessation of exports from Russia has become a serious menace to the dry-battery and flint-glass industries. Prices as high as $85 a ton are freely offered, but as only a few deposits in the United States can supply ore of this grade, little domestic ore has come to the market. There is record of a marketed production of 550 tons from mines in Arizona, California, Colorado, Utah and Virginia during 1915, whereas the annual demand ranges from 20,000 to 25,000 tons. Ore of this grade was imported during 1915 from Japan and Cuba.

The Adverse Possession of Mining Property

In a suit to recover possession of a lode mining claim in Utah, it was decided by the supreme court of that state that there can be no such adverse possession of land as may ripen into title through mere occupancy under claim of ownership where title has not passed out of the United States and where claimant is not seeking in good faith to acquire regular title from the Government. (Utah Copper Co. vs. Eckman, 152 Pacific Reporter, 178.)

Another point decided in the same case depends upon the Utah statute which provides that mining property shall be taxed at the price paid the United States therefor, unless the surface or some other part of the real estate be used for nonmining purposes, in which case that part is to be taxed at its value for such purposes. Under this section the court holds that a person who has been in possession of the surface of a mining claim under assertion of ownership for the statutory period which ripens adverse possession into legal title, and who has in the meantime improved the surface, may be assessed for taxation to the value of the surface and its improvements, and that his payment of such taxes will support his claim of title to such part of the property as against the owner of the mining claim.

Electric Headlights for Mine Locomotives

The increasing use of electric locomotives underground makes imperative the use of headlights that will satisfactorily illuminate the pitchy darkness often prevalent. This affords a source of protection to the employer that he cannot afford to ignore; often preventing possible litigation that might otherwise be experienced through injury to employees.

A thorough investigation by the General Electric Co.'s engineers into the requirements of mine illumination, of which the headlight unit is a most important part, has occasioned the design of headlights for locomotives, descriptions of which follow:

Fig. 1 shows an arc headlight composed of a solid cast-iron frame with hinged cast-iron door of very rugged construction, weighing 69 lb., the pick-up distance of which is from 1,000 to 1,200 ft. ahead with the standard electrode and 1,300 to 1,500 ft. with the high-efficiency electrode.

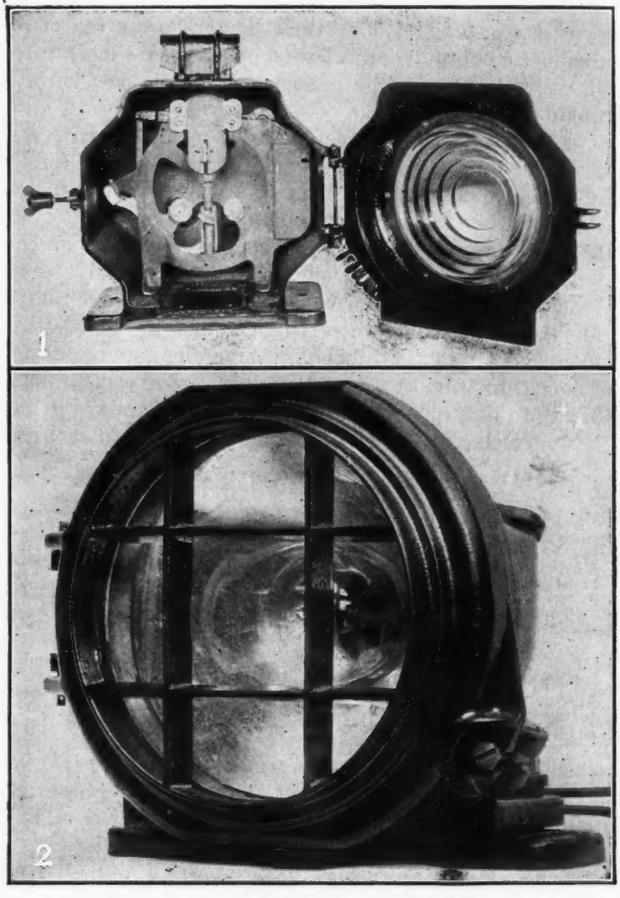
This type has been designed primarily for use in the long hauls where the loaded and unloaded trains are operated at comparatively high speeds. There is, however, another field for a lower-powered headlight, and for this reason a unit has been designed, operating substantially on the same principle as that already described, but with a lower rating for use on locomotives making the short hauls and gathering.

This headlight is provided with a two-compartment casing, weighs 35 lb. and has a pickup distance of from 500 to 700 ft. in front of the locomotive.

In the majority of instances in mining practice, locomotives are provided with a double-end equipment, consisting of two headlights, a single rheostat and two snap switches with fused cutouts, the negative leads of the headlight being grounded, while the positive leads are connected to the supply side of the rheostat and the feeder side of the rheostat is connected directly to the trolley circuit. There are conditions, however, which make it desirable to use a single headlight, where there is not room to mount two, one at each end of the locomotive. The use of a single headlight makes it necessary that the beam be directed in either direction toward which the locomotive may travel. For this reason a headlight with a turret has been developed.

It is desirable on low-voltage lines (250 to 220 volts) that the overhead construction and rail-bonding be in good condition, otherwise the line drop in remote sections of the mines will be excessively high and the line voltage correspondingly low. Good overhead construction and returns add to the efficiency of all mining equipment, including the locomotive headlight.

For a number of years past many mine locomotives have been equipped with incandescent headlights, a novel form of which is shown in Fig. 2, in which electrical and lighting efficiency as well as economy of occupied space has been considered. This headlight is composed of a solid cast-iron casing with hinged door, removable cast-iron cover and a sub-base. In general mining practice the 105- to 125-volt lamps are more commonly used. The pick-up distance for this headlight when used with the 110-volt, 72- and 94-watt lamps is from 500 and 600 ft., so that



LUMINOUS ARC AND INCANDESCENT HEADLIGHTS

with this particular lamp, in many cases, the headlight can be used on the long hauls, while with the lamps of lesser wattages the headlight can be as well adapted for the short hauls.

The Production of Tungsten Ore in Argentine according to Consul General W. Henry Robertson, Buenos Aires, has been controlled largely by one company, the Hansa Mines (Ltd.), a German concern which is reported to be affiliated with the Krupp interests of that country. Up to about six months ago it operated the only mine in this Republic, located at Concaron, in the Province of San Luis. This one mine can produce approximately 50 tons a month, when operating at full capacity. Until the outbreak of the war its entire output was shipped to Germany. The total Argentine exports of tungsten ore from 1909 to 1913, inclusive, amounted to 3,319 metric tons. Of this amount, 3,309 tons went to Germany and 10 tons to Great Britain. The exports to the latter country were in 1909 and 1910. Since then, up to 1915, Germany has been the only purchaser.

Stope Surveying at Mount Lyell*

SYNOPSIS—A novel scheme for stope surveying, made necessary by the extremely irregular character of the ore deposit and the absence of definite boundaries. The contour-line method is used in plotting the openings, and a careful system of frequent measurement is followed.

The method of stope surveying as practiced at the Mount Lyell company's mines has been evolved out of the exigencies created by special conditions. It presents some novel features and has proved effective for all requirements. All stope-measurement work is brought under one complete system, to which office methods are standardized. Before proceeding to deal with the subject, a brief description of the physical characteristics of the orebodies of each mine and the method of stoping will serve to show cause for departure from ordinary survey practice.

The orebodies of the North Lyell mine occur on or near the conglomerate-schist contact, and being probably the result of replacements of both rocks, they rarely present any definite walls. It is usual for the payable material to merge into the respective country rocks, and the limit of the occurrence is defined rather by assay value than by any distinct natural boundaries. The general configuration of these orebodies, therefore, is highly erratic both in horizontal and vertical section, so that in order to obtain an accurate record of any occurrence, the measurement of the actual contour at short vertical intervals is essential.

Stoping is carried out on a modification of the rill system, perhaps more properly described as arched-back or "dome" stoping. Mullock[1] rises are placed in as convenient positions as the erratic configuration of each orebody will allow, and around these rises the back is kept well-arched, both longitudinally and transversely. The larger stopes are divided into arbitrary sections in which ore-breaking and mullocking are carried out in rotation, so that the whole excavation is seldom open for measuring at any one particular time. Stacking or square-setting on the mullock rill is employed where unfavorable ground is cut, and discontinued as the back becomes stronger. Square-sets, closely followed by mullock, are used for picking up the level above, one or more floors being adopted, the number depending on local conditions. Fig. 1 typically illustrates the peripheral changes these orebodies exhibit between levels. The first outline shows the ground floor at the 1,000-ft. level, then follow contours at intervals of 10 ft. up to 60 ft. The last is the ground floor plan at the 850-ft. level.

The Mount Lyell Mine

In the Mount Lyell mine the orebody is a lenticular mass of pyrites occurring at the junction of schist and conglomerate, the latter forming the foot wall of the deposit. It is irregularly eliptical in contour, and pipe-like, or columnar, considered vertically. Taken generally, it is sharply defined against the inclosing rocks, and there is not the gradual shading into either schist or conglomerate that obtains with the North Lyell orebodies. Occasional inclusions of schist are found, however.

Extraction has been carried out by opencutting down to No. 5 level, the portion below this being worked by underground methods. Exploration work having established the dimensions of the body, it was possible to carry out stoping operations to a predesigned scheme of pillar-and-stope mining. The pillars are 25 ft. in thickness, and the stopes are beaten out over floor areas varying up to 15,000 sq.ft.

Stoping is done exclusively on the arched-back method, each stope having a centrally situated rise connected to the mullock-pass system. The back is cut out dome-shaped from the commencement of overhead breaking. The picking-up of the level above thus begins around the rise, and the depleted area enlarges as the domed roof ascends until the whole of the ore is stoped to the pillars or walls. About six feet of back is broken between successive mullockings, yielding a quantity of ore varying in the different stopes up to 15,000 tons.

At both the North Lyell and Mount Lyell mines the ground floors are timbered wholly or partly with square-sets. In the latter case gallery sets are stood to provide access to ore passes and for through traffic. The periodical surveys of these ground floors are performed by the ordinary methods observed in most mines.

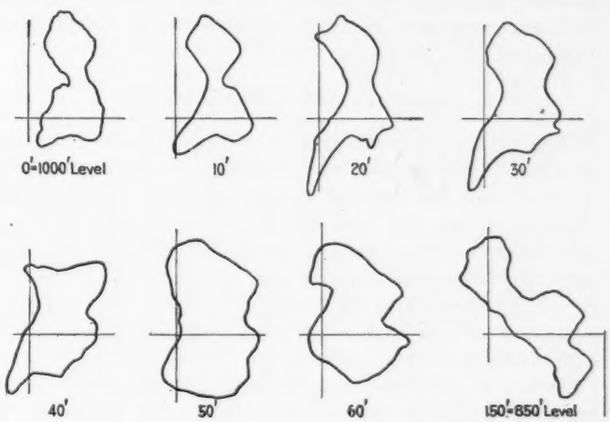


FIG. 1. OUTLINES OF STOPE SECTIONS

The measurement of the overhead portion of these stopes, however, at the outset presented difficulties resultant on the scheme of stoping adopted. The highly irregular shape of many of the stopes, combined with the steep slope of the mullock rill, made the problem of effecting comprehensive surveys something beyond the practical scope of ordinary stope-survey methods. Under these circumstances the taking of parallel cross-sections at equal distances was found to be too unwieldy in practice and insufficient for requirements.

The system inaugurated, which has been since successfully followed, is one of "contour surveying." By it field and office work are simple and, for the extent of ground covered, rapidly performed, the suitability of the resulting contour plans, both as records and for working guidance, being pronounced. It is of paramount importance that the shape of the domed arch should be

*An article by G. F. Jakins and L. J. Coulter, published in "Proceedings of the Australian Institute of Mining Engineers," N. S., No. 19, 1915.

[1]Country rock, or waste.

carefully studied, especially in relation to outside factors that do not appear in an actual inspection of the stope. Exploratory work has frequently to be undertaken in stopes as they are carried up, and the accurate piecing together of all information gained is necessary to provide facilities for stoping where the orebody develops some local eccentricity. It is of the utmost importance to have on record the precise shape and the geological features of the orebody from the ground floor upward as a guide for laying out any subsequent work that may be necessary. In many of the larger stopes the picking-up stage is reached at the top of the dome before the lower portion has left the ground floor, and owing to this large vertical range a considerable amount of fresh information becomes continuously available, from which necessary variations in the original scheme for working the lower portion can be made.

Stopes are measured before each mullocking and also at half-yearly intervals, for the purpose of computing extractions and ore reserves, and it is not common practice to measure stopes for ascertaining extracted quantities over shorter periods. Contractors are paid on truck tallies, and actual tonnages for cost purposes, etc., are allocated from four-weekly weighbridge receipts. The system of ore transport also admits of intermediate quantity checks. It is only on rare occasions that it is found necessary to make measurements for progress payments.

Performance of Field Work

The field work performed in a contour survey consists in observing a number of points on the walls and back of the stope, so that their position and height above floor level can be fixed on a plan and contour lines interpolated. Field measurements are effected by using both the horizontal and vertical circles of the theodolite in conjunction with the measuring tape, the surveyor requiring two assistants—a rodman and a tapereader.

Connection to the overhead portion of a stope is made from the level below by a direct horizontal and vertical traverse wherever practicable. This can generally be done in a stope where the lower portion has not left the ground floor. The instrument is set under the nearest permanent level station, and a traverse run to the most convenient point for sighting up into the stope. At this point the instrument is set, and its height above floor level measured. The rodman then drives the first peg on the mullock rill and gives the surveyor a plumb-line sight for bearing. The rod is next held on the peg, a reading taken, and the vertical angle recorded. The tape is then stretched from the instrument to the observed point on the rod and the chainage booked. The notes are entered in diagrammatic form (Fig. 2).

Here 108° 46′ is the bearing from station 1 on the level to station 2 in the stope. The height of the instrument is 4.7 ft. above floor level, and 27.6 ft. is measured on an inclination of 23° 40′ to a point 2.8 ft. above station 2.

From station 2 the rodman arranges for a third station in the stope, and this is traversed to from station 2 in a similar way, and so on until sufficient stations are placed in the stope from which to make the required observations. In these traverses angles are booked to the nearest minute, and chainages and heights to the nearest tenth of a foot. Angles of elevation are marked + and depression —. The first set of observations is taken from station 2, and in the following way: The instrument is set up for both limbs and placed in meridian by setting the back bearing, sighting station 1, and plumbing. The rodman clips the ring of the tape and a lighted candle to the end of the rod and holds it against any selected point on the wall.[2] The tapereader holds the box at the intrument and calls the measurement, paying out or winding in as is required. The bearing and vertical angle are read, and the rod is then moved toward the instrument in the same vertical plane to another point, which is observed in a similar way. After this additional points are taken as considered necessary, still on the same bearing.

The notes are booked in sketch form (Fig. 3).

The rodman then moves to another point along the wall, and further observations are taken on a new bearing, and so on until a radiating set of sections has been completed around station 2. The instrument is then moved to station 3, where the procedure is repeated, and so on until the survey is finished.

The angles in these observations are booked to the nearest 10′ and distances to the nearest half-foot, it being needless refinement to attempt greater accuracy on

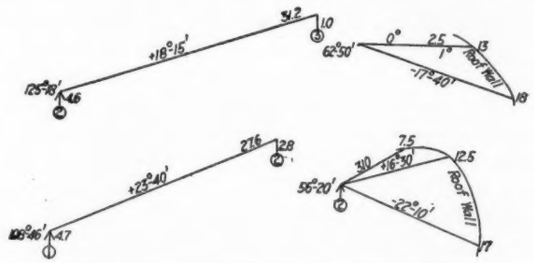


FIG. 2. NOTEBOOK DIAGRAMS. FIG. 3

a rough surface such as a stope presents. The angles are read directly from the plates, without employing reading glass or vernier scale. In this way shots are very rapidly taken, and a stope requiring, say, three observing stations can be measured with ground-floor connection easily in 1½ hr. A surveyor generally reckons 15 to 20 min. for each station, at which he will take from 40 to 60 points after setting up his instrument.

Selecting Proper Stations

Judgment has to be shown in selecting stations that will give a good command over the area to be observed. Stations involving measurements to points more than 40 ft. distant are generally inadvisable, and the survey is better effected by inserting an extra one. The surveyor should avoid picking up small local crevices and bumps, which are unimportant in themselves and needlessly distort the contour lines. On an average, adjoining sections should intercept the walls about 6 ft. apart, and each section should not be followed back too close to the instrument, else a surfeit of information will be collected round the station. Only sufficient points should be taken to insure a good general survey of the roof.

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[2]A convenient type of rod for this work consists of two pieces of 1-in. "tamping stick," each 5 ft. 6 in. long. These can be fitted together to make an 11-ft. rod by slipping the end of one piece into a ferrule fitted on the other. The rod is painted in feet with alternate black and white rings. The end of the rod is fitted with a clip to hold the candle, and the ring of the tape is also fastened to it. The tape used is an ordinary 66-ft. metallic box-band.

In a stope where the whole working has left the ground floor, a satisfactory connection can sometimes be obtained by sighting up an inclined ladderway; or use may be made of an underlay winze from the level above. Occasionally a line may be established up in the stope itself along a timbered gangway, etc., which may be left open enough to afford connection for several successive surveys.

Where such means are not available and the stope is a large one, two ladderways are selected, one at each end of the stope. If possible, a wire is hung in each from the top and connected to the permanent traverse on the ground floor. When the ladderways are too crooked to admit of this being done, a combination of plumbing and traversing has to be effected, generally with the aid of wall plate and diagonal eyepiece, care being taken during such work to make permanent any points likely to be of service in subsequent surveys.

The two points thus established in the stope above are included in the stope traverse, which is conducted on an observed magnetic meridian, and afterward corrected by calculation with the bearing between the wires on the level below. Such a case is shown in Fig. 4. In measuring this stope two ladderways were used, and wires *A* and *B* were suspended and observed from stations 12 and 16 on the ground floor. The instrument was then taken into the stope, and set on station 1, where a magnetic-needle observation was taken for a meridian on which all bearings read in the stope were temporarily based.

On the completion of the survey the bearing on the level between *A* and *B* was calculated via stations 12 to 16, information from the office coördinate book being used to facilitate the computation. The bearing between *A* and *B* was then calculated via stations 1 to 6 in terms of the temporary stope meridian, and the correction to all stope bearings entered in the notes, so that the adjustment could be made in plotting.

In this work the length *AB* in both traverses is also computed and gives a useful check on the accuracy of the stope traverse. Another good check is obtained on the vertical heights as measured up one ladderway, through the stope by medium of instrument and tape, and down the second ladderway. Any difference of floor level at *A* and *B* being known, the vertical coördinates of the stope traverse can be then balanced. As these calculations can be effected in a few minutes with a slide rule, the surveyor generally prefers to so balance his work before he leaves the stope. Wire connections may be similarly made through vertical winzes from the level above.

Where a small portion only of a stope is open and requires measurement, a single-wire connection is made from the floor level, or level above, to the stope. A magnetic observation is taken in the stope for meridian and adopted for the survey. If ordinary precautions are taken against local attraction, this meridian can be relied upon within 20′, and is sufficiently close for the small area to be surveyed.

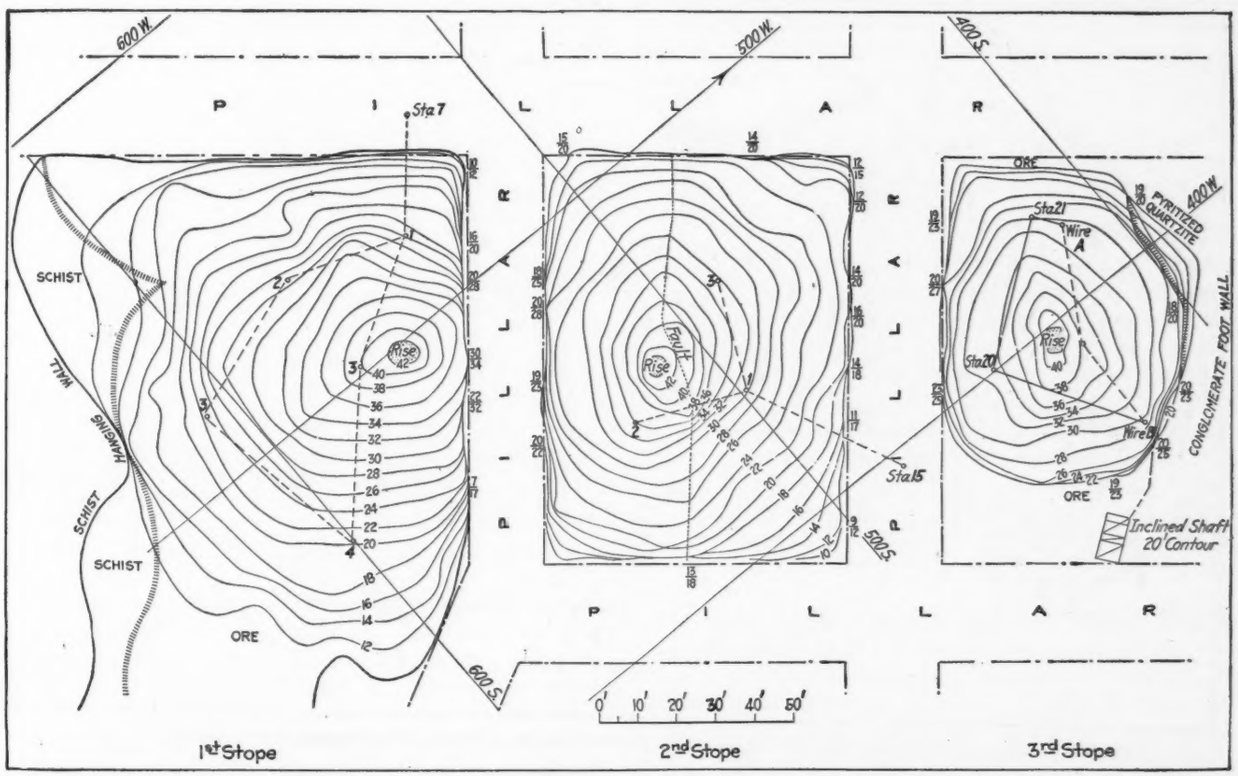

FIG. 4. PLAN SHOWING CONTOUR OF STOPE ROOFS, NO. 7 LEVEL, MOUNT LYELL MINE

In Fig. 5 is shown contour plans of stopes across the Mount Lyell orebody. In Nos. 1 and 2 stopes direct traverses were made into the stopes from crosscuts through the pillars on the ground floor. The arrangement of the observing stations is also shown. In the case of No. 2A stope a two-wire connection was made, a single observing station being sufficient for the measurement. In No. 1 stope the schist hanging will exposed is marked, while in No. 2A stope a flat portion of the foot wall is shown between the 18-ft. and 22-ft. contours.

Field notes are kept on the loose-leaf system and filed in the office in special books kept for each stope. All calculations of connections are made and tabled in the fieldbook. Before going underground to make a survey, the notes of any previous connections likely to be of service are transferred from the office file to the fieldbook. One connection can sometimes be used for several surveys, or the connection of an old survey may be slightly modified or extended to serve a subsequent one.

Contour plans are drafted on tracing linen to a 10-ft. scale, and contour lines are shown 2 ft. apart vertically. The office work of a contour survey begins with the reduction of the field measurements into horizontal and vertical components, and this reduction may be effected either graphically or by calculation. The former method has been superseded by the latter, with marked advantages. In view, however, of the fact that the method of calculation involves the use of the slide rule to be practicable, it may be interesting to describe the graphic method, which successfully dealt with these reductions before the slide-rule method was adopted.

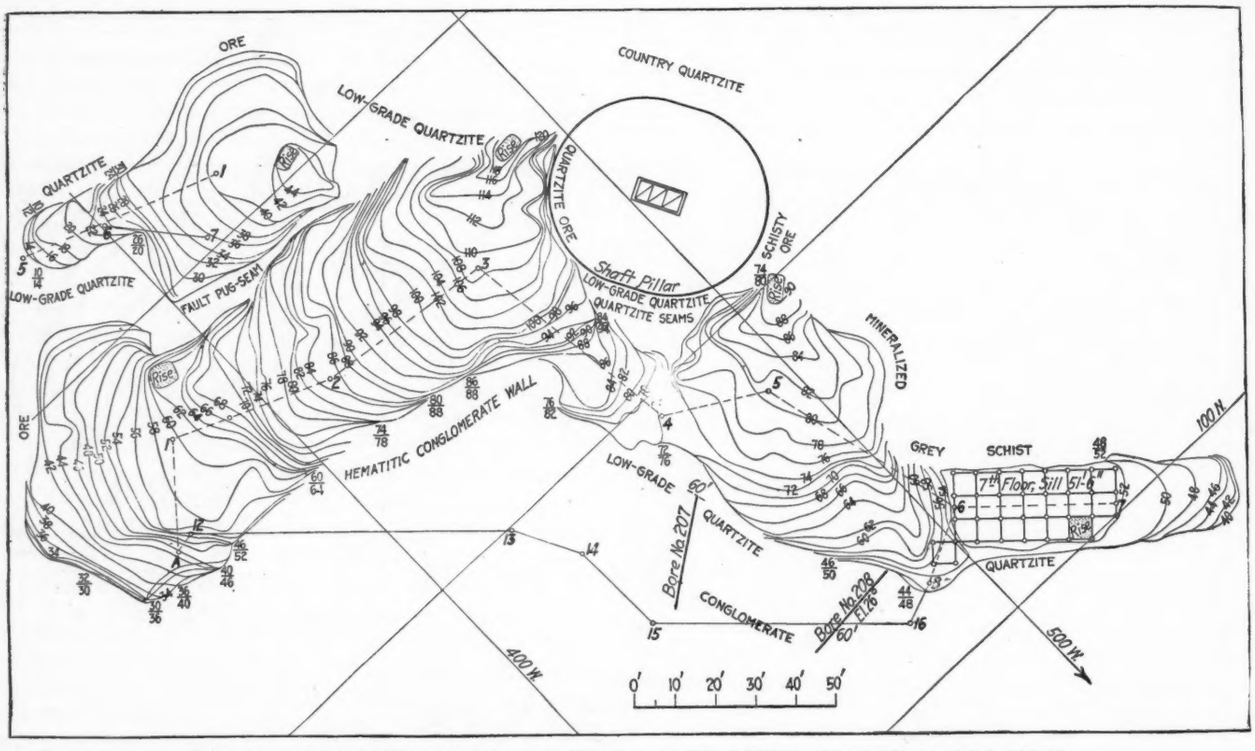

FIG. 5. CONTOUR PLAN OF LARGE STOPE, 850-FT. LEVEL, IN NORTH LYELL MINE

The graphic method consists in first preparing a separate graph plan on 10-ft. scale, on which all measurements are plotted in one vertical plane. The coördinates are then scaled and transferred to the contour plan on their several respective bearings.

The graph plan is first prepared by ruling it with parallel horizontal lines to correspond with the 2-ft. contour intervals. Then, to instance the method of procedure, if we take the notes given in Figs. 2 and 3, station 1 is first placed on the graph, with the height of the instrument 4.7 ft. above floor level. The line from 1 to 2 is then set off on an elevation of 23° 40′ and length 27.6 ft. with protractor and scale, the position of 2 being obtained by measuring down 2.8 ft. from the end of this line. The height of the instrument over 2 is then marked, and the line 2 to 3 set out in a similar way. The sections taken from 2, Fig. 2, are then plotted.

The second method of reducing the survey measurements to horizontal and vertical coördinates—that is, by calculating the actual heights and distances—is to be preferred, provided the results can be conveniently attained and entered in the field notes. The time involved in plotting the graph is saved, and the draftsman plots direct from the field notes all information gained by the survey. In addition to the convenience of this, he is better able to reconcile the different results gained in the survey, and a more reliable plan is likely to result. A means has, however, to be selected so that these computations can be quickly and easily performed. Mathematical tables must be set aside as too combersome for such a purpose, but a diagram may be brought within range of practicability in spite of its complicated appearance. Such a diagram may be prepared by marking angles from 0° 90° by lines radiating from an origin and setting out slope distances by arcs centered at it. The vertical and horizontal components of any radius on any vertical angle may be then obtained by reading the corresponding ordinate and abscissa, the diagram being ruled with horizontal and vertical lines to facilitate the operation.

The most efficient means, however, is the slide rule. In this work reductions are easily made with the rule and entered in the notes at the rate of 250 observed points or 500 calculations per hour. In actual practice it is found that mistakes are singularly rare and are almost invariably detected in plotting, so that, while it was formerly the custom for the draftsman to check the surveyor's reductions, the plot is now regarded as sufficient safeguard against error. It must be pointed

out that the measured lines are short, and the limits of accuracy observed in the field are 10′ and 6 in., so that any attempt at greater accuracy than 6 in. in the reduction of these measurements is unnecessary.

The plotting of the contour plan proceeds as follows: The stope traverse is drawn in the ordinary way, except that horizontal components of slope measurements are found in the notes. The protractor is then set over each station in turn, and the observed points with their vertical heights above floor level marked. The area thus becomes covered with a number of level points, from which the contour lines are interpolated.

The preparation of a contour plan thus made takes from one to five hours, according to the area of stope measured and the detail required apart from the contour lines. The total time saved over the graphic method is one-third. This of course includes all reductions made by the surveyor.

Iu preparing a contour plan the use of colored inks based on a conventional system has distinct advantages in presenting a plan clear in detail. For instance, floor-level traverses are shown red, stope traverses black, contour lines sienna, underfoot contours blue, and so

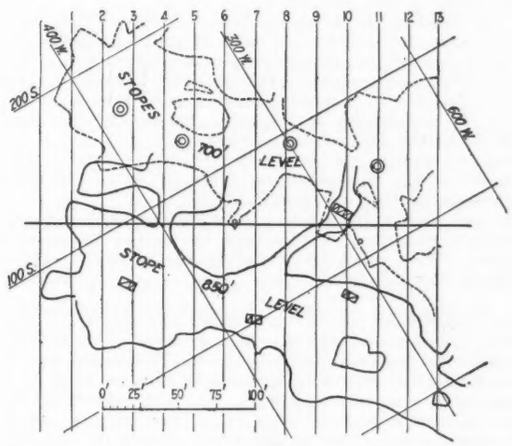

FIG. 6. SURVEY OF STOPES ON TWO LEVELS

on. Before the finished contour plan is filed, it is used for the preparation of the following plans and sections: A representative longitudinal and transverse section is struck and added to a plan showing a series of such sections arranged in composite chronological order. This is useful in presenting a general idea of the doming and the progress of exploitation of the stope. A plan is then prepared, for the underground foreman, of any stope in which one or more fixed boundaries, such as pillars, have to be observed. The foreman's working guide to a pillar generally consists of two or more ore passes which are reared against it. The positions of these passes are noted each survey and entered on the tracing, which also shows the position of the pillar, so that any tendency toward enroachment or want of alignment may be ascertained and corrected.

The contours at 10-ft. intervals above floor level are reduced by pantograph to 30-ft. scale and plotted on a special set of plans kept for superimposing on the working-level plans, for general information and for model-building purposes, etc. Each contour, bearing its survey date, is dotted until it reaches the wall of the orebody, continuing along it in a full line. Ore reserves are computed from a series of sections along parallel lines through the orebody between two levels. The direction of these lines is made as transverse to the body as its known irregular shape will allow. The layout of a typical set of sections is shown in Fig. 6, which deals with a portion of an orebody between the 850- and 700-ft. levels. The lines are 20 ft. apart horizontally, and numbered in rotation. The drawing shows how the work is carried out.

The finished contour plan is finally filed in the booklet of plans of that particular stope. It is inserted in correct coördinated position over the plan compiled from the previous survey, with which it can be closely compared through the transparent linen. Any alterations in form of the orebody that is being developed can thus be studied and information obtained for laying out any exploratory work deemed necessary, or for varying the existing scheme of stoping. The method is capable of considerable variation and is flexible.

The special fitness of such a working plan continually presents itself as providing means for considering stopes in a concrete manner with much greater convenience than is possible with a series of detached contours or sections.

Mine Equipment as Part of Realty

By A. L. H. Street*

A development company holding an option to purchase a Montana lode-mining claim hired an electric hoist from plaintiff at an agreed monthly rental of $50, and the hoist was installed at the mine and used. The development company having forfeited its right to purchase the claim, the mining property was sold to defendant, who refused to surrender the hoist, claiming that it had become a part of the real estate purchased by defendant. Suit brought to recover possession lately terminated in plaintiff's favor, as shown by the decision handed down by the Montana Supreme Court in the case of Montana Electric Co. vs. Northern Valley Mining Co. (153 Pacific Reporter, 1017).

The court holds that the question whether mining equipment installed at a mine becomes a part of the real estate or retains its character as chattel property is primarily to be determined by the intention of the parties to the contract under which the installation was made. Here it is held that intention to make the hoist a part of the real estate was negatived by the understanding that it should be returned to plaintiff when the period of hiring terminated. The fact that the hoist was placed upon a substantial foundation and an engine house constructed over it did not prevent it from being removable as a chattel, it appearing that that could be accomplished without material injury to the realty.

Whatever may be the rights of an innocent purchaser of a mine to assume that equipment affixed to the land was intended to become a permanent part thereof, it is held that in this case defendant was deprived of any such rights by reason of the fact that notice was imparted to defendant's promoter and chief stockholder and principal officer before defendant bought the mining property, disclosing plaintiff's interest in the hoist.

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Arizona Production in 1916

The mines and smelteries of Arizona have been working at a pressure so high in 1916 that they are probably making record productions of all metals. If they continue to work at the present rate during the year, they will make an output of over 600,000,000 lb. of copper, against about 450,000,000 lb. in 1915, according to reports received by the United States Geological Survey from Victor C. Heikes, of the Salt Lake office. The probable corresponding increase in the output of precious metals and in that of lead and zinc will, at the greatly increased prices, make the total value of the output in 1916 nearly double that of 1915, which was about $88,000,000.

Thus Arizona not only retains first place as a copper producer, but is producing at a rate nearly double that of any other state. Aside from a general effort to take advantage of an unusually active market, several factors have aided this increase, such as the settlement of the strike at the Clifton-Morenci mines in January. The International smelter, which treats Inspiration ore, contributes the greatest part of the increase, for this plant is supplying about one-fourth of the total copper. Marked increases and improvements were made at the United Verde, Miami, Calumet & Arizona and Old Dominion mines, and the Sasco plant in Pima County was again blown in. The railroad to Ajo was completed, and work has been begun there on a 4,000-ton leaching plant. There is great activity in the production of gold, especially in Mohave County, and the high price of zinc has stimulated production at the Tennessee, Union Basin and Kingman zinc properties. The mill at the Union Basin mine was enlarged, and work at the San Xavier mine in Pima County was resumed.

Government Reports Elaborate Concrete Strength Data

As Technologic Paper No. 58, the United States Bureau of Standards, S. W. Stratton, director, has just issued a most extensive resumé of the properties of concrete. The title of the bulletin is "Strength and Other Properties of Concretes as Affected by Materials and Methods of Preparation," and it has been prepared by Rudolph J. Wig, engineer-physicist, G. M. Williams, assistant engineer-physicist, and E. R. Gates, assistant physicist, all of the Bureau. The book, which contains 172 pages, including 38 tables and 44 diagrams, may be obtained from the Bureau of Standards or the Superintendent of Documents, at Washington.

The data presented include the results of some 20,000 tests. Compressive and tensile tests were made upon mortars at different ages, including about 240 different sands and stone screenings, and compressive tests were made on concretes composed of 60 aggregates, including limestones, gravels, granites, cinders and trap rock, as well as tests of the physical properties of the sands, stone screenings and coarse aggregates. These data furnish information on the range of strength values which were obtained with different aggregates in various consistencies, with variation in workmanship of fabrication, in the method of placing, and in subsequent exposure.

The results of such an elaborate series cannot be given here, but as an indication of the scope of the series there are appended, from *Engineering News,* the conclusions arrived at by the authors. The tabulations and diagrams themselves form one of the most valuable contributions to the knowledge of concrete so far made public. The conclusions are as follows:

PORTLAND-CEMENT MORTAR MIXTURES

Sand as a type of fine aggregate cannot be said to be superior to limestone screenings.

The proper gradation of the fine aggregate for maximum strength in a mortar appears to vary for different materials.

The results of the tests of the mortars included in this paper would indicate that for most materials the highest strengths are obtained with those having a gradation of particles approaching a straight line. There are materials, however, having a gradation varying widely from a straight line, which give high strength in mortars.

The quality of a sand cannot be judged from its gradation alone. Any limitation arbitrarily placed upon the proportions of the particles of various sizes will probably eliminate some very satisfactory materials.

No fine aggregate should be rejected because of its "silt" content determined by washing or assuming the material passing the No. 200 sieve as silt, as it may be advantageous even in relatively large quantities or detrimental in small quantities, depending upon its form, character and distribution.

Mortars having high density usually have high strength.

The quality of sands to be used in cement mortars cannot be determined from their "uniformity coefficients."

There is no difference in the strength developed by rounded and sharp-grained sands.

The quality of sands cannot be determined from their specific gravity and porosity.

Sands having a gradation approaching Fuller's curve for maximum density do not have as great strength as sands having a gradation approaching a straight line.

The only satisfactory method of determining the value of a fine aggregate in mortar mixtures is to test it in the mixture in the proportion to be used, exposed to the same conditions as in the proposed structure.

Common usage has demonstrated that certain sands are satisfactory, and therefore no tests of these materials are necessary excepting to identify them.

The relative value of several fine aggregates to be used in concrete cannot be determined by testing them in mortar mixtures. They must be tested in the combined state with the coarse aggregate.

PORTLAND-CEMENT CONCRETE MIXTURES

(A) Relation of Type of Aggregate to Compressive Strength—No type of gravel or stone aggregate can be said to be generally superior to any other type used as coarse aggregate in concrete mixtures. Certain limestones are superior to certain gravels, and some gravels are better than other limestones. The range of qualities in any of these types is very great, and the strengths of concretes made up of several different materials of the same type may vary as much as several hundred per cent. with all other controllable factors uniform.

(B) Relation of Workmanship to Compressive Strength—Undoubtedly greater uniformity is generally obtained by machine mixing than by hand mixing. The method of mixing is of little importance so long as it results in a homogeneous mass. Using proper methods and with the expenditure of sufficient labor, results indicate that as good concrete can be obtained by hand mixing as by machine mixing, although it probably would not be economical.

With all other factors constant the results included in this paper show that differences in manipulation of the mixture by the workmen of several experienced concrete contractors may cause a maximum average variation in the compressive strength of the resulting concrete of 70% or more.

(C) Relation of Consistency of Mixture to Compressive Strength—The quantity of water added to the mixture in preparing concrete affects materially the compressive strength at all ages. With the proper quantity of water the strength may be several hundred per cent. greater than that obtained with a large excess of water.

The most satisfactory consistency from the standpoint of strength and durability is a quaking or mushy mixture, and the error should be on the side of using too little rather than too much water, providing it is properly spaded or worked into place in the forms. This statement does not apply to the very dry mixtures used in the manufacture of concrete blocks, etc. In the case of these products the mixture should contain the maximum quantity of water which will permit of the immediate removal of the molds. This latter mixture has less water than the quaking consistency described above.

(D) Relation of Density to Compressive Strength—With the same aggregates and the same proportion of cement to total volume of aggregate the mixture having the greatest density will have a high and usually the highest compressive strength.

Density is no criterion of compressive strength of two mixtures of an aggregate if the ratio of cement to total volume of aggregate is not the same.

Density is no criterion of compressive strength of two mixtures of the same proportions of cement to total aggregate if different aggregates are used, although when the aggregates are quite similar they may be comparable.

(E) Effect of Various Exposures on Compressive Strength—The character of the exposure of the concrete after molding materially affects its compressive strength. If the original water is permitted to evaporate from the concrete and all water is subsequently excluded, the compressive strength may be reduced 40% or more. Concrete should preferably be kept wet for several days or weeks after it is deposited if the maximum strength is to be attained.

(F) Effect of Exposure to Steam on Compressive Strength—Steam greatly accelerates the hardening process and will increase the strength of concrete only a few days old by several hundred per cent., depending on the temperature and duration of exposure.

(G) Relation of Gradation of Aggregate to Compressive Strength—There is no definite relation between the gradation of the aggregate and the compressive strength which is applicable to any considerable number of different aggregates.

The gradation curve for maximum compressive strength, which is usually the same as for maximum density, differs for each aggregate.

The so-called maximum density curve, which is a combination of the straight line and ellipse does not represent the curve for maximum density excepting for the particular materials used in the tests from which it was derived, or very similar materials.

No equation for a gradation curve, which can be applied to a number of different aggregates, can be prepared from the results included in this paper.

Maximum density and maximum strength are usually obtained with a concrete in which the ratio of fine to coarse aggregate is not less than 1 to 3. This mixture is usually quite stiff and therefore more difficult to handle than a mixture containing a larger percentage of fine aggregate.

Excessive fineness does not necessarily result in a totally unsatisfactory sand for concrete. A seashore sand having 99% passing a 50-mesh sieve, when mixed with a good coarse aggregate and cement, was found to give a satisfactory concrete.

(H) Relation of Proportions to the Compressive Strength—With the relative volume of fine and coarse aggregates fixed the compressive strength of a concrete increases directly as the cement content but not in a proportionate ratio. An increase in the ratio of cement to total fine and coarse aggregates when the relative proportions of the latter are not fixed does not necessarily result in an increase in strength. For example, a concrete mixed in the proportion of 1 part cement to 9 or 10 parts of total fine and coarse aggregates combined so as to give a maximum density may have greater strength than a concrete mixed in the proportion of 1 part cement to 6 parts total of the same fine and coarse aggregates, which are not combined to give a maximum density.

GENERAL CONCLUSIONS FROM THE TESTS

1. No standard of compressive strength can be assumed or guaranteed for concrete of any particular proportions made with any aggregate unless all the factors entering into its fabrication are controlled.

2. A concrete having a desired compressive strength is not necessarily guaranteed by a specification requiring only the use of certain types of materials in stated proportions. Only a fractional part of the desired strength may be obtained unless other factors are controlled.

3. The compressive strength of a concrete is just as much dependent upon other factors, such as careful workmanship and the use of the proper quantity of water in mixing the concrete, as it is upon the use of the proper quantity of cement.

4. The compressive strength of concrete may be reduced by the use of an excess of water in mixing to a fractional part of that which it should attain with the same materials. Too much emphasis cannot be placed upon the injurious effect of the use of excessive quantities of water in mixing the concrete.

5. The compressive strength of concrete may be greatly reduced if, after fabrication, it is exposed to the sun and wind or in any relatively dry atmosphere in which it loses its moisture rapidly, even though suitable materials were used and proper methods of fabrication employed.

6. The relative compressive strength of concretes to be obtained from any given materials can be determined only by an actual test of those materials combined in a concrete.

7. Contrary to general practice and opinion the relative value of several fine aggregates to be used in concrete cannot be determined by testing them in mortar mixtures. They must be tested in the combined state with the coarse aggregate.

8. Contrary to general practice and opinion the relative value of several coarse aggregates to be used in concrete cannot be determined by testing them with a given sand in one arbitrarily selected proportion. They should be tested in such combination with the fine aggregate as will give maximum density, assuming the same ratio of cement to total combined aggregate in all cases.

9. No type of aggregate such as granite, gravel or limestone can be said to be generally superior to all other types. There are good and poor aggregates of each type.

10. By proper attention to methods of fabrication and curing, aggregates which appear inferior and may be available at the site of the work may give as high compressive strength in concrete as the best selected materials brought from a distance, when the latter are carelessly or improperly used.

11. Density is a good measure of the relative compressive strength of several different mixtures of the same aggregates with the same proportion of cement to total aggregate. The mixture having the highest density need not necessarily have the maximum strength, but it will have a relatively high strength.

12. Two concretes having the same density but composed of different aggregates may have widely different compressive strength.

13. There is no definite relation between the gradation of the aggregates and the compressive strength of the concrete which is applicable to any considerable number of different aggregates.

14. The gradation curve for maximum compressive strength, which is usually the same as for the maximum density, differs for each aggregate.

15. With the relative volumes of fine and coarse aggregate fixed, the compressive strength of a concrete increases directly, but not in a proportionate ratio as the cement content. An increase in the ratio of cement to total fine and coarse aggregates when the relative proportions of the latter are not fixed, does not necessarily result in an increase in strength, but may give even a lower strength.

16. The compressive strength of concrete composed of given materials, combined in definite proportions and fabricated and exposed under given conditions can be determined only by testing the concrete actually prepared and treated in the prescribed manner.

17. The results included in this paper would indicate that the compressive strength of most concretes, as commercially made, can be increased 25 to 100% or more by employing rigid inspection which will insure proper methods of fabrication of the materials.

The Canada Copper Corporation, Ltd., which is the holding company of the British Columbia Copper Co., with mines in the Boundary District and a smeltery at Greenwood, B. C., states in its annual report for 1915 that the profit from operations during the last five months of 1915, the only part of the year during which the smeltery was operated, was $66,033, from which is deducted general expenses incurred during the non-operating period amounting to $23,378, an amount payable under the power contract of $67,572, making a total of $90,951, thus showing a deficit for the year of $24,917.

Since the first of 1916 the sale of the Emma mine has been negotiated for a sum of $55,000, which goes into the company treasury.

As of Dec. 31, 1915, it is estimated that there are 9,075,000 tons of reasonably assured ore and 2,000,000 tons of probable ore of an average grade of 1.75% copper, and 20c. recoverable in gold and silver. This estimate increases approximately 60%, the probable ore reserves of the company over last year's estimate.

Attention is called by the general manager to the fact that the profits from the Greenwood smelting plant for the five months of operation are largely due to the extraordinarily high price of copper, and he continues, "On account of the rapid depletion of the company's ore reserves in the Greenwood district, the period of smelting activity is limited, unless a profitable custom ore business can be developed or new ore found. The high price of the metals has stimulated mining and it is considered not unlikely that the market for custom ores will further improve during the coming year.

Details of Practical Mining

Dip and Strike Calculations from Drill-Hole Data

By George E. Burton*

The following calculation is used to obtain the dip and strike of a stratum of rock from the data acquired in three drill holes:

Let *MM'* (Fig. 1) represent the surface of the ground, and *V*, *Z* and *X* be three vertical drill holes which encounter the same stratum of rock at points *C*, *A* and *B* respectively. Let point *C* have the lowest sea-level elevation, point *B* the highest, and point *A* intermediate between the two. Draw *AB*, *BC* and *AC*.

Pass the plane *EFC* through the point *C* perpendicular to the drill holes *Z* and *X*, cutting *Z* at point *E* and *X* at point *F*. Draw *EF*, *EC* and *FC*. Draw *AH* parallel to *EF*. Extend *AB* until it intersects the plane determined by the points *E*, *F* and *C* at *D*. Draw *DC*; the

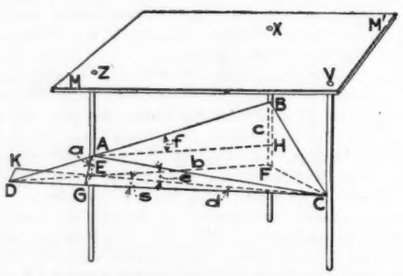


FIG. 1. THREE HOLES CUTTING STRATA AT DIFFERENT ELEVATIONS

bearing of the line *DC* is the strike of the stratum *ABC*, since it is the line of intersection of the plane *ABC* with the horizontal plane *DFC*.

The bearing of the line *EC* is known, so to calculate the bearing of the line *DC* it is necessary only to find the angle *ECD*.

Draw *EG* perpendicular to *DC*. Draw *AG*, then angle *AGE* measures the dip of the stratum as it measures the dihedral angle *B-DC-F*, and this dihedral angle is formed by the intersection of the plane of the stratum *DBC* with the horizontal plane *DFC*. Therefore, to find the dip of the stratum it is necessary only to find the angle *AGE*.

In the right triangle *ABH*, *AH* and *BH* are known, and angle *BAH* can be found from the formula,

$$Tan\ BAH = \frac{BH}{AH}$$

But angle *BAH* = angle *ADE* (alternate interior angles).

In the right triangle *AED*, *AE* and angle *ADE* are known, and *DE* can be found from the formula,

$$Cot\ ADE = \frac{DE}{AE}$$

In the triangle *DEC*, *DE* and *EC* are known, and the angle *DEC* = 180° — angle *FEC*. Since angle *FEC* is known, angle *DEC* can be found. We have given, then, an oblique triangle with two sides and the included angle known.

From *D* let fall a perpendicular in the horizontal plane cutting the line *EC* (extended) at point *K*. In the triangle *DKC*:

$$Tan\ ECD = \frac{DK}{KE + EC}$$

$$Sin\ (180° - DEC) = \frac{DK}{DE}$$

$$DK = DE\ sin\ (180° - DEC)$$

but

$$180° - DEC = \text{angle } FEC$$

therefore

$$DK = DE\ sin\ FEC$$

$$Cos\ (180° - DEC) = cos\ FEC = \frac{KE}{DE}$$

therefore

$$KE = DE\ cos\ FEC$$

Substituting in $Tan\ ECD = \frac{DK}{KE + EC}$

$$Tan\ ECD = \frac{DE\ sin\ FEC}{DE\ cos\ FEC + EC}$$

Substituting knowns for unknowns in the foregoing equation,

$$Tan\ ECD = \frac{AE\ cot\ BAH\ sin\ FEC}{AE\ cot\ BAH\ cos\ FEC + EC}$$

$$Tan\ ECD = \frac{AE \times \frac{AH}{BH} \times sin\ FEC}{AE \times \frac{AH}{BH} \times cos\ FEC + EC}$$

In order to simplify the formula, let

$AE = a$, the difference in elevation between the stratum in hole *V* at *C* and in hole *Z* at *A*;

AH or $EF = b$, the surveyed distance between holes *Z* and *X*;

$BH = c$, the difference in elevation between the stratum in hole *Z* at *A* and in hole *X* at *B*;

$EC = d$, the surveyed distance between drill holes *Z* and *V*;

Angle $FEC = e$, surveyed horizontal angle at hole *Z*;

Angle $BAH = f$, the angle included between a line drawn in the plane of the stratum connecting holes *Z* and *X* and a line drawn from the point of intersection of this line with hole *Z*, perpendicular to hole *X*;

Angle $ECD = s$, angle to be added to or subtracted from the bearing of the horizontal line connecting holes *Z* and *V* to determine the strike of the stratum;

*Assistant director, Oklahoma Geological Survey, Norman, Okla.

Angle $AGE = D$, angle of dip of the stratum. Then

$$Tan\ S = \frac{a \times \frac{b}{c} \times sin\ e}{a \times \frac{b}{c} cos\ e + d} = \frac{\frac{ab\ sin\ e}{c}}{\frac{ab\ cos\ e + ed}{c}}$$

$$Tan\ S = \frac{ab\ sin\ e}{ab\ cos\ e + cd}$$

the angle to be added to or subtracted from the bearing of the line EC to determine the strike of the stratum.

In the right triangle CEG, EC (d) and angle ECG (s) are known, and EG can be found from the formula $tan\ S = \frac{EG}{d}$. $EG = d\ tan\ S$.

In right triangle AEG, AE (a) and EG ($d\ tan\ S$) are known, and the angle AGE (D) can be found from the formula (for finding the dip of the stratum), $tan\ D = \frac{a}{d\ tan\ S}$.

There are two special cases to the foregoing: Case 1, where all three drill holes encounter the stratum at the

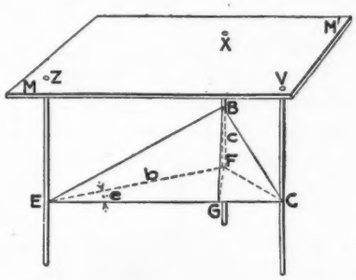


FIG. 2. THREE HOLES, TWO OF WHICH ARE AT THE SAME ELEVATION

same sea-level elevation, in which case the stratum is level and there is no dip or strike; case 2, where two of the drill holes encounter the stratum at the same sea-level elevation, in which case the strike is the bearing of the horizontal line connecting these two drill holes and the dip can be calculated.

Let MM' (Fig. 2) represent the surface of the ground, and let the vertical drill holes V and Z encounter the same stratum of rock at point C and E, which have the same sea-level elevation, also let drill hole X encounter the stratum at point B, which has either a higher or a lower sea-level elevation than points E and C.

Pass the plane EFC through the line EC perpendicular to drill hole Z and cutting hole X at point F. Draw FG perpendicular to line EC and connect B and G. The bearing of the line EC is the strike of the stratum. The angle BGF (D) is the angle of dip as it measures the dihedral angle B-EC-F, and this dihedral angle is formed by the intersection of the plane of the stratum EBC with the horizontal plane EFC.

In the right triangle EGF angle e and the hypotenuse b are known, and leg FG can be found from the formula, $sin\ e = \frac{FG}{b}$. $FG = b\ sin\ e$.

In the right triangle BFG, c and FG are known, and angle BGF (D) can be found from the formula, $tan\ D = \frac{c}{b\ sin\ e}$ which is the formula for finding the dip of the stratum.

Relation of Wheelbase to Radius of Curve*

The tendency of car wheels to climb the rails on a curved mine track must be taken into account in planning haulage systems. The question therefore arises as to what should be the relation between the car wheelbase and radius of track curvature in order to reduce to a minimum the danger that the car will jump the track. For example, suppose the car wheelbase is 28 in. and it is desired to find the minimum safe radius of track curve, keeping in mind the extra expense involved in driving a long curve underground.

Assuming that the rigid four-wheeled truck common on mine cars and illustrated in the accompanying diagram, showing truck, is to be used, it may be stated that when such a truck strikes a curve in the track, the flange of the forward outside wheel A grinds along the gage line of the outer rail, by reason of which the truck $ABCD$ is continually shifted to a more or less radial position on the curve. It has been found by many experiments with small models that the rear axle of the truck, marked CD in the figure, assumes a radial position provided the gage of the track is widened sufficiently to permit it to do so. But if the gage is not widened sufficiently, the curvature of the track forces the rear axle out of the radial position, causing the rear inner wheel C to chafe that rail.

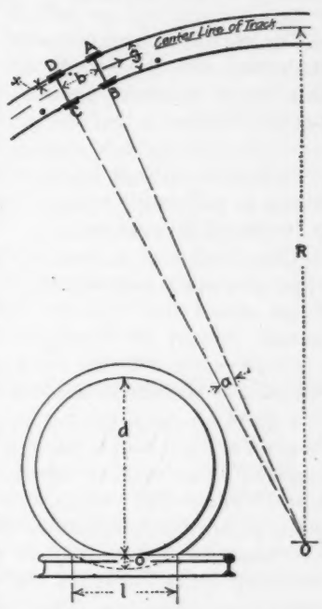


DIAGRAM SHOWING TRUCK ON CURVE

The natural or ideal position of the truck on the curve is shown at $ABCD$ in the figure.

It is readily seen that any effort of the forward outer wheel A to force the rear axle CD from its radial position, by reason of the track gage not being sufficiently widened, increases the tendency of the wheel A to climb the rail. The ideal condition is realized when the track gage is so widened that the rear axle CD of the truck coincides with the radius of the curve when the flange of the wheel A is in contact with the gage line of the outer rail.

In the lower part of the accompanying figure is shown a car wheel having a diameter d and resting on a section of rail, the flange of the wheel having a width o, as indicated in the figure. It is necessary to explain here that in the plan given only that portion of each wheel is shown extending below the rail tread, corresponding to the length of the chord l in the lower diagram.

When estimating the necessary increase in gage of track for sharp curves, in order to realize the ideal condition to which we have referred, it is necessary to calculate the half-length of the chord l by the formula

$$\tfrac{1}{2}l = \sqrt{o(d + o)}$$

*"Coal Age," June 24, 1916.

The flanges of mine-car wheels are usually 1⅛ in. deep, making the value of the half-chord for an 18-in. wheel

$$\tfrac{1}{2}l = \sqrt{1\tfrac{1}{8}(18 + 1\tfrac{1}{8})} = 4.6\ in.$$

For sharp curves this half chord must be added to the wheelbase b and their sum divided by the radius of the curve, all being expressed in inches, which gives the sine of the angle BOC included between the radii drawn to the centers of the two respective axes of the truck. Then multiply the versed sine of this angle (1 — cos) by the radius of the curve expressed in inches, and the product will be the amount x that it is necessary to increase the track gage in order to realize the ideal condition.

For example, assuming 18-in. wheels and a 28-in. wheelbase, the radius of the curve being, say 50 ft., we find the sine of the angle included between the two radii

$$Sin\ BOC = \frac{28 + 4\ 6}{50 \times 12} = 0.05433$$

The corresponding cosine of this angle is 0.99852 and its versed sine 1 — 0.99852 = 0.00148. Multiplying this by the radius of the curve expressed in inches gives for the distance x that the gage must be increased,

$$x = 50 \times 12 \times 0.00148 = 0.888,\ say\ \tfrac{7}{8}\ in.$$

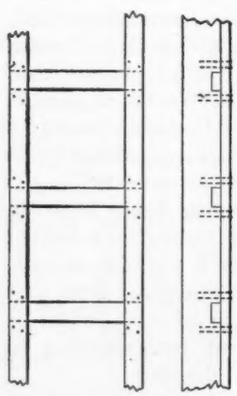
Care must always be taken that the tread of the car wheels is sufficiently wide to span the rails when the gage is increased this amount.

The driving of a long curve, though expensive, will often save much trouble and decrease the cost of operation to an extent that will far outweigh the first cost. In general it may be stated that the minimum radius of curve increases with the track gage and speed of hauling. Where it is possible to adopt a 50-ft. radius when hauling at a speed of, say 6 mi. per hr., with a 2½- or 3-ft. gage, in mule or light-motor haulage, a minimum radius of 60 or even 75 ft. should be adopted for hauling at a speed of 8 or 10 mi. per hr. over a 3½- or 4-ft. gage. In special cases, particularly with mule haulage and a narrow gage, the minimum radius may be reduced to 40 ft. without incurring serious trouble. When employing large locomotives a radius less than 100 ft. should not be used.

A Ladder for Wet Raises

By Charles A. Mitke*

The accompanying illustration shows a ladder for use in wet raises, suggested by John Hughes, a foreman in the Copper Queen. There are a number of cases where acid water eats up the nails in the ladder rungs, causing the rungs to fall off, making them dangerous when anyone attempts to go up or down. This arrangement eliminates such danger because the strip on each side of the ladder holds the rungs and prevents any of them from falling out. Of course the strips are also nailed, but there would be less chance of all the nails on the strip failing than in the usual arrangement in which the rungs are nailed on instead of being countersunk.



LADDER WITH COUNTERSUNK RUNGS

*Copper Queen Consolidated Mining Co., Bisbee, Ariz.

Rail Clamp for Steam Shovel

By L. D. Davenport*

Fig. 1 shows the ordinary rail clamp used in many of the openpit mines on the Mesabi Range, to block the wheels of steam-shovel trucks. A tie is ordinarily used for a block and is placed between the clamp and the wheels. These clamps fit loosely over the section rail and are tightened by driving steel wedges between the clamp and the ball of the rail. The improved clamp shown in Figs. 2 and 3 has been in use for several years

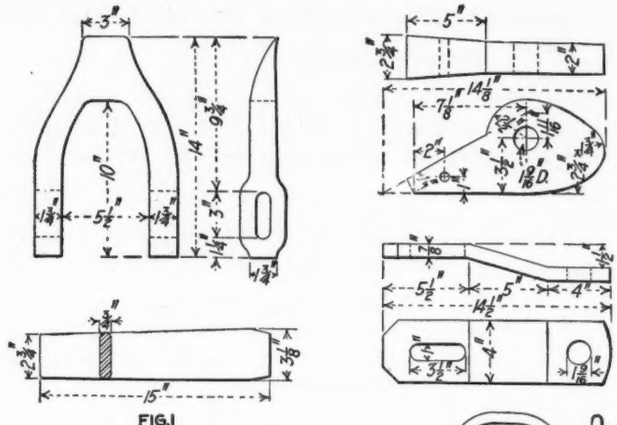


FIG.1

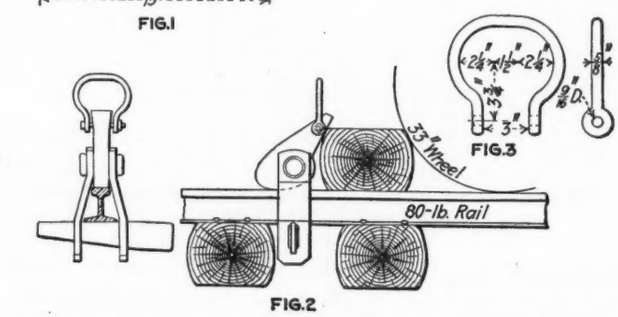


FIG.2

FIG.3

DETAILS OF RAIL CLAMP USED TO HOLD STEAM SHOVEL

in one of the Hibbing district openpits and has proved entirely satisfactory. The important feature of this clamp is the cam which rests on the ball of the rail and is tightened by the pressure of the block against it, doing away with the wedges used on the ordinary type. The handle on the top of the cam offers a safe and easy means of handling the clamp.

Slag as a Road Base

An article appearing recently in *Engineering News* called attention to the use of slag as a base for brick roads in portions of Pennsylvania adjacent to the steel plants. Formerly either stone or slag was specified, but at present slag alone is named.

This seems to suggest an economical source of base for roads in the vicinity of smelteries. Where granulation is employed, the slag could be used for the subgrade and also in the concrete surface. Where the slag is delivered to waste in a molten condition it can be broken up when needed and used similarly to broken stone for macadam roads.

*Oliver Iron Mining Co., Hibbing, Minn.

Details of Milling and Smelting

A New Method of Expressing Protective Alkalinity

By H. H. Howry*

The following is what I believe to be a new method of expressing protective alkalinity in cyanide solutions. It seems to have some points that make it preferable to the old way of expressing it as so many pounds of CaO per ton of solution. This method and the accompanying chart were worked up by me last December and have been in use here since. The protective alkalinity is expressed as a percentage value.

From the equations,

$$2KCN + H_2SO_4 = 2HCN + K_2SO_4$$

and

$$CaO + H_2SO_4 = CaSO_4 + H_2O$$

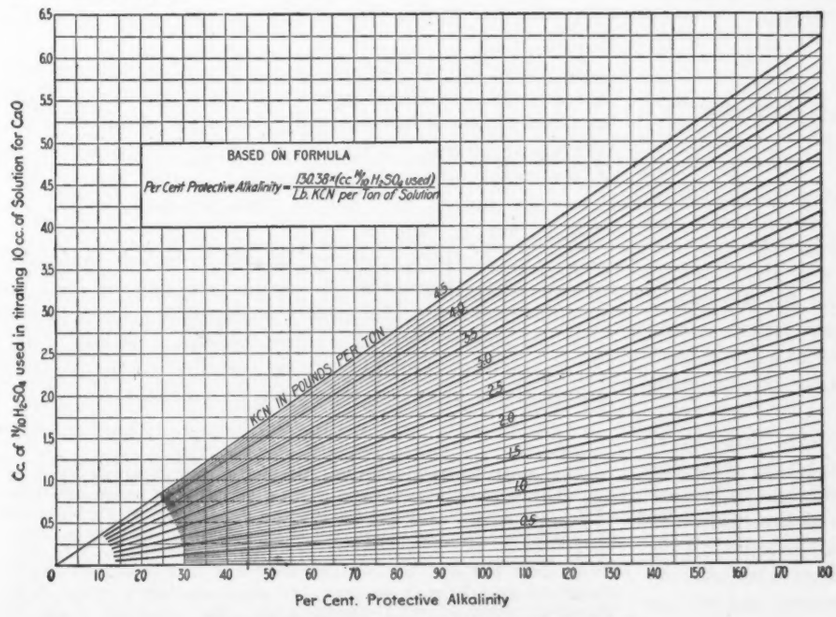
we get a factor for changing alkalinity due to CaO and to its equivalent alkalinity due to KCN. This factor is CaO = 2.32245KCN. This theoretical factor checks experimentally fairly closely if phenolphthalein is used as indicator; if methyl orange or other indicators are used, the carbonates, etc., in the water throw the result off a good deal.

If we use N/10 H_2SO_4 for titrating and take 10 c.c. of solution, then every c.c. of H_2SO_4 used represents 0.5614 lb. of CaO per ton of solution. Hence our formula for protective alkalinity becomes

$$\textit{Per cent. protective alkalinity} = 100 \times 2.32245 \times 0.5614 \times \frac{\textit{c.c. N/10 } H_2SO_4 \textit{ used}}{\textit{lb. KCN per ton}}$$

A concrete example of how to use the accompanying chart may not be amiss. Ten c.c. of solution is titrated for KCN by the familiar $AgNO_3$ titration with KI indicator. After excess $AgNO_3$ is indicated, an excess of potassium ferrocyanide is added to prevent any zinc present from precipitating as zinc hydrate. Then the N/10 H_2SO_4 titration with phenolphthalein indicator is performed. Suppose that our solution titrated 2.5 lb. KCN per ton and that it required 2.0 c.c. N/10 H_2SO_4 to destroy the red color. Go up on the left edge of the chart to 2.0 c.c. H_2SO_4, then horizontally across to meet the diagonal 2.5 lb. KCN line, then from the intersection of these two lines go down vertically to read 104% protective alkalinity. This method gives, in my opinion, a much clearer idea of the relative protective alkalinities in solutions of various cyanide strengths than does the usual method of expressing it as merely so many pounds of CaO per ton of solution. If, as is the case here, NaCN is used in place of KCN, the formula and chart still hold, provided the cyanide present is expressed in terms of KCN.

*Mill foreman for the United States Gold Corporation, Sugar Loaf, Colo.


BASED ON FORMULA
Per Cent Protective Alkalinity = 130.38 (cc N/10 H2SO4 used) / Lb. KCN per Ton of Solution
KCN IN POUNDS PER TON
Cc. of N/10 H2SO4 used in titrating 10 cc. of Solution for CaO
Per Cent. Protective Alkalinity

THE PROTECTIVE ALKALINITY CHART

Separating Wolframite from Tin

By Alexander Grossberg*

Wolframite in small quantities has been known for some time to exist in the tin ores from the "Inca" vein of the "Salvadora" property of Simon T. Patiño, at Uncia, Bolivia. Before the war started, the sales (in Europe) of tin concentrates produced in the mills here were made in such a way that the tungstic-acid content was paid for in part and therefore there was no necessity for separating this metal under the existing prices. Since the beginning of the present war, however, the high prices of tungsten ores, the nonpayment for tungstic-acid content in tin concentrates and the depreciation of the tin concentrates due to the presence of tungstic acid made it necessary as well as profitable to separate this metal from the tin.

The milling plant at Uncia has as one of its units a good Humboldt-Wetherill magnetic-separator installation for the treatment of a highly pyritic middling product, so that, on account of the magnetic condition of the wolframite contained in the ores, this plant was naturally turned to the separation of this mineral from the tin concentrates.

The tin concentrates, as produced in the mill, vary in size from 8 mm. to that which passes 200-mesh, and as the greater part of the tungstic-acid

*Superintendent of mills, Uncia, Bolivia.

content has been shown to exist in the "coarse," this is ground to pass a 2-mm. screen and the whole is then passed over two Humboldt-Wetherill magnetic separators where the materials are subjected to a separation.

The separators are run at 110 volts with 4 amp. on the first magnet and 12 amp. on the second. The first magnet removes a product consisting of traces of tungstic acid, about 50% of magnetic pyrite and about 5% of tin. The second magnet removes practically all the wolframite along with some feebly magnetic pyrite that has not been removed by the first magnet. The tin is unaffected and therefore passes off from the feed belt ready to be sacked for shipment.

The first-magnet product is sent to the roasting plant in order to recover the tin contained. The second-magnet product contains around 50% tungstic acid and 20% of pyrites. This product is given a surface roast to convert the feebly magnetic pyrites into a highly magnetic product, the roasted mixture then being passed over the same magnet as the original concentrates. In the latter case, however, the first magnet is worked with 2 amp. During this operation the first magnet removes practically all the iron sulphide along with traces of tungstic acid and the second magnet makes a shipping product containing about 60% tungstic acid, thus producing a satisfactory commercial material.

The mill at the present time produces about 20,000 Spanish quintals of tin concentrates per month from which is recovered approximately 110 Spanish quintals or 5.5 tons (short), of wolframite of the grade mentioned.

The cost of producing the 60% wolframite concentrates is approximately 12.56 Bolivianos ($4.77 at actual exchange) per Spanish quintal. This is of course very high, being due in great measure to the location of the separator plant with reference to the drying floor for tin concentrates, which makes a great deal of hand-transportation necessary and this item runs up the cost considerably. Changes are being made which will cut down these costs about 50%. The mine gives promise of continuing the production of wolframite for some time to come. In general, the country promises to be an important source of this material in the future.

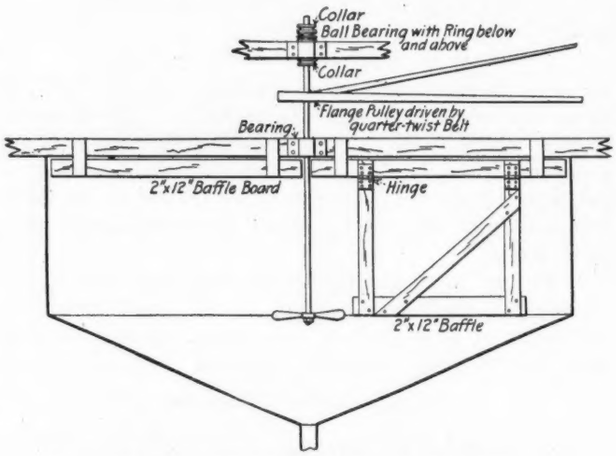
Propeller Slimes Agitator

By Roscoe Wheeler*

The installation of the Devereux propeller system of agitation, mentioned in the *Journal* of May 6, 1916, has been successfully continued at the milling plant of the Hedley Gold Mining Co. The efficiency of the propeller for agitation purposes depends largely on the fineness of the slimes and the breaking of the vortex formed around the vertical shaft. This vortex, if allowed to exist, retards the velocity of the pulp, thus decreasing the scouring action.

The vortex is broken by baffle boards 2 in. thick by 12 in. deep suspended from the lower chord of the truss and extending from a few inches from each side of the vertical shaft to within 3 in. of the inner side of the tank. To allow agitation while the tank is filling and to prevent the pulp from surging, another baffle board is suspended by hinges from one of the former baffle boards and on one side only of the vertical shaft. The rope holding this baffle in vertical position while tank is filling is slackened as soon as the tank is full, thus allowing this baffle to lie flat on the surface of the charge and not interfere with the scouring action below. From Trautwine, page 577, a velocity of ¼ ft. per second will wear away ooze and mud; ½ ft. per second will wear away clay; 1 ft. per second will wear away sand.

With the 5-ft. propeller revolving from 80 to 100 r.p.m., maximum hp. = 12, the 34-ft. diameter, conical-bottomed tank has handled from 80 to 165 tons of dry slimes. Then 138 tons of dry slimes plus 296 tons of solution, or 31.8% of solids to 68.2% of solution, is an ordinary charge and is agitated thoroughly with 80 r.p.m. The 4-ft. propeller revolving 80 to 100 r.p.m. maximum hp. = 10, in the 30-ft. diameter, conical-bottomed tank will handle 138 dry tons of slimes (41.4%) plus 238 tons of solution (58.2%) when revolving 80 r.p.m. Either tank will handle slime charges with any proportion of solution used in ordinary cyanide work, and the power



THE PROPELLER SLIMES AGITATOR

does not exceed that stated. There is no deposit of slimes alongside the staves, the whole charge being in rapid motion.

As extraction is effected by a series of agitations and decantations, one might expect trouble in starting. Thus far none whatever has occurred, even after two days' time between agitations. With the throwing in of the handle of the motor starter, the propeller begins setting the charge in motion, and by the time the tank is full all slime is moving rapidly.

The cost of these propellers is said to be less than half that of any other agitators going into new as well as remodeled plants. The system is dependent upon power from one source only—air is not needed. Its simplicity and adaptability permit it to be installed in plants containing tanks of any style, height or diameter.

*Mill superintendent, Hedley Gold Mining Co., Hedley, B. C.

The Best Electrolytic Tin Deposits are obtained from a stannous-ammonium oxalate bath with peptone as an addition agent. A good composition, according to Frank C. Mathers and Barrett W. Cockrum ("Trans." Am. Electrochem. Soc., Washington, D. C., meeting) is: 5% stannous oxalate, 6% ammonium oxalate, 1.5% oxalic acid and 0.25% peptone. The stannous oxalate may be made by precipitating a solution of stannous chloride with oxalic acid. The solution must be stirred at intervals and is run at 3.6 amp. per sq.ft. at room temperature.

The Assayer and Chemist

Improved Test for Molybdenum

By George A. James*

The test for molybdenum originated by Schoenn and improved by Masche consists in treating a portion of the substance with a small quantity of sulphuric acid on a porcelain or platinum surface and evaporating to near dryness.

By the addition of water in minute quantities, such as results from breathing on the mass, the appearance of a distinct blue coloration indicates molybdenum. This result is not always easily obtained with molybdenite unless the sulphur is oxidized with nitric acid, and in the case of wulfenite it sometimes fails entirely.

An improvement, I have found, that accentuates this reaction and prevents its disappearance, is the addition of some glacial acetic acid. When this is slightly heated, the blue color appears immediately and persists.

In connection with this subject I would call attention to the frequent appearance of wulfenite with gold ores, which in the pan hangs back with the gold, for which it is often mistaken. To test this, a portion is treated with nitric acid and a drop of sulphuric acid and heated until white fumes appear. On the addition of glacial acetic acid, the typical blue reaction appears strongly. If another portion is treated with acetic acid, the addition of potassium bicromate will give a strong yellow precipitate.

Analysis of Aluminum Alloys

In a paper at the recent meeting of the Institute of Metals (London, Mar. 29, 1916), W. H. Withey describes a new method of analysis for aluminum alloys that allows the use of large quantities of the composition. To the filtrate, after removal of the copper-tin group by sulphureted hydrogen in acid solution, tartaric acid is added and the solution then made alkaline. The tartaric acid then holds up aluminum when H_2S is passed in, while zinc and nickel are quantitatively precipitated. Manganese is only partly precipitated. After the H_2S treatment, the solution filtered from sulphur is made ammoniacal and the magnesium precipitated with sodium phosphate. The precipitate is redissolved. The precipitate is next dissolved in dilute nitric acid, and any manganese which is usually present determined by a calorimetric method and calculated into the equivalent weight of manganese pyrophosphate, which is then deducted from the magnesium pyrophosphate obtained. The manganese is separately determined in another sample.

The method recommended for the analysis of the alloys of aluminum and zinc consists in adding to the solution an excess of caustic soda. The hydroxides first precipitated are thus dissolved, and on passing sulphureted hydrogen the zinc is precipitated. The precipitate is dissolved and the zinc after the removal of traces of aluminum is determined as phosphate.

The method seems almost as great a step as was the ferric-hydrate precipitation for the metalloids in the analysis of metallic copper.

Pouring Assay Melts Upon A Flat Plate

By G. H. Clevenger*

The conventional conical iron molds have been universally used by assayers for the reception of assay melts, and while the method of pouring upon a flat iron plate is by no means new, strangely enough a description of it does not appear in the literature on assaying.

Upon the completion of fusion the lead button rests on the bottom of the crucible, with the molten slag above. During the time the crucible remains in the furnace after this stage is reached, the most favorable conditions exist for the complete separation of the lead from the slag by settling. When the fusion is poured into a conical mold, the slag largely leaves the crucible first, then

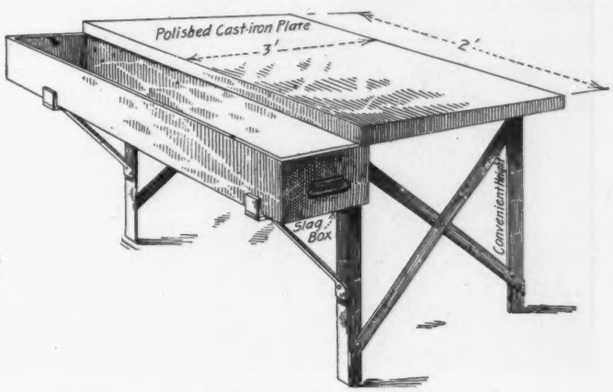


FIG. 1. STAND AND FLAT PLATE

the lead, and following the lead the small amount of remaining slag. At the moment the molten slag strikes the conical mold there is necessarily a slight chilling effect, which causes the thin layer of slag in contact with the iron mold to become viscous, if not actually solid. Into the slightly chilled large mass of slag falls the lead button, which at once sinks to the bottom of the mold, where it finds a resting place on the thin layer of highly chilled slag. As the molten lead falls through the slag, opportunity is afforded for the entrainment of small particles of lead. However, with properly proportioned charges, if sufficiently hot when poured, there is little tendency for the slag to retain shot lead. When the solidified melt is removed from the mold, the sides of the button are found to be incased in a thin layer of slag, and the top of the button is more or less firmly attached to the large mass of slag. The union between slag and button at this point is sometimes so strong that in re-

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*Associate professor of metallurgy, Stanford University, California.

moving the slag a thin layer of the button is taken with it. In any event a considerable amount of hammering is necessary to free such a button from the adhering slag.

Use of a Flat, Polished Iron Plate Found Advisable

It is evident that if a method of pouring were used in which the relative position of the lead and the slag was not changed during pouring, there would be less likelihood of particles of the lead being entrained in the slag, and moreover, a button would be obtained which would be much more free from slag. I have found that pouring upon a flat iron plate largely accomplishes this end, as well as presenting certain other advantages. After experimenting with plates set at different angles, as well as with special plates having depressions of various shapes for the accommodation of the button, it was found that a flat cast-iron plate, which of course must be smooth and preferably polished, gives the best results. The plate can be mounted upon a gas-pipe or angle-iron rack of convenient height, as shown in Fig. 1. At one end is a pair of brackets which support a sheet-iron box into which the rejected slag is swept by a counter brush. Before using for the first lot of fusions, the plate should be slightly heated. In the absence of other means, this may be readily accomplished by pouring a sufficient amount of gasoline on it to more or less cover the surface, igniting and wiping off with a rag the thin film of water that remains after the gasoline burns. After the first fusions have been poured, no further attention need be paid to the temperature of the plate, as the succeeding pourings keep it sufficiently warm. When pouring, the crucible should be held in such a position that the slag may be observed as it flows from the crucible. After the major portion of the slag has left the crucible and the lead becomes visible, the crucible should be drawn slightly toward the operator, so that when the lead runs out, it does not fall directly into the mass of the slag, but strikes the edge of the partly solidified slag next to the operator, which acts as a dam, breaking the force of its fall. A little practice with this apparently difficult manipulation makes one entirely proficient in its operation. The appearance of a set of melts poured upon a flat plate is shown in Fig. 2. A plate of moderate size, say 2x3 ft. will accomodate 24 melts.

In a surprisingly short time both the lead and the slag are solidified. The button may therefore be picked up for cupellation almost at once, whereas with the conical mold a considerable time is necessary for the lead and the slag to solidify, and then not infrequently, the assayer in his haste will disturb the melt before the lead is solid. Even after the slag is solid and apparently the whole mass in the mold is solid, the lead may still be liquid, because of its lower melting point. The buttons resulting from pouring on a flat plate when the operation is properly conducted are in one mass, and in general are perfectly clean and free from slag with the exception of the little rim or margin of the button *AA* in Fig. 2, which is directly in contact with the slag. All that is necessary to prepare the buttons for cupellation is to bend them over so that they can be placed in the cupel. Time spent in forming the perfect cubes with carefully flattened corners by hammering, which is a tradition of assaying, is merely wasted, as there is no slag to remove—hence little hammering is required. Another difficulty that is sometimes encountered with the conical mold, that is not apparent with the flat plate is the sticking of the slag and button to the molds. When the slag once begins to stick to a mold, this difficulty gradually becomes worse until the mold is thoroughly cleaned and scoured. If through accident the slag should contain beads of lead, these are far more apparent in the thin cake of slag when held up to the light than in the more compact mass of slag resulting from the use of the conical mold, and can be separated and recovered easily.

A somewhat greater degree of skill is necessary in pouring upon a flat plate, and furthermore, the pouring requires a slightly longer time than when using the conical mold, but the other advantages more than compensate for these slight drawbacks.

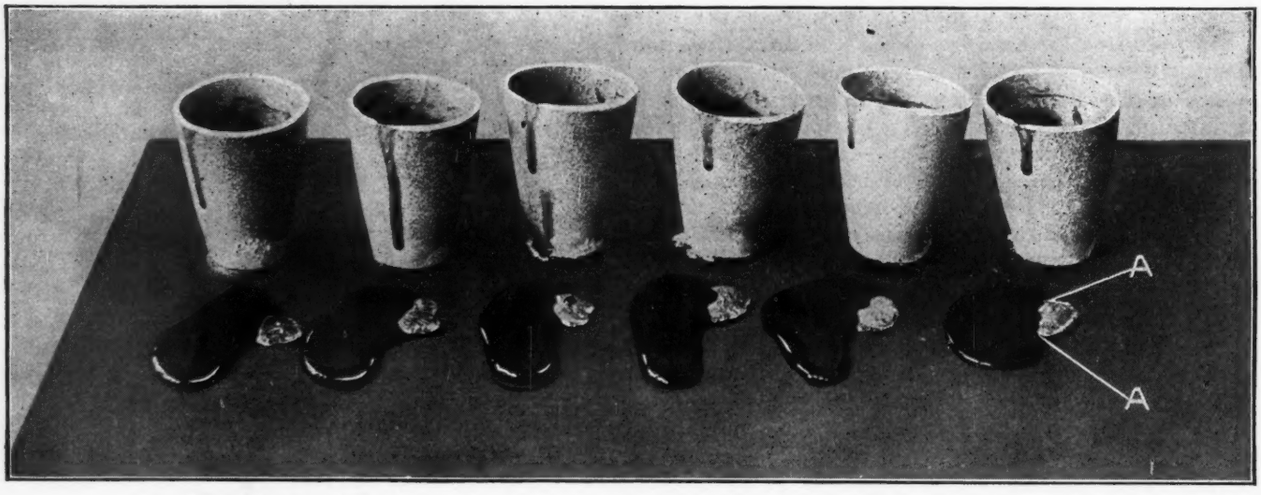

FIG. 2. ASSAY MELTS ON FLAT PLATE, SHOWING SEPARATION OF BUTTON AND SLAG

The Recently Adopted Atomic Weight of Cadmium, 112.4, is disputed by de Coninck and Gerard, according to the "Chemical Trade Journal," who obtain a figure 112.32 as the mean of five closely agreeing determinations. Their method is said to have been to calcine to carbonate and reduce the residual oxide with hydrogen, weighing the final metallic cadmium.

Steel Production in 1915

The production of steel in the United States in the year 1915 is given by "Special Bulletin No. 3" of the American Iron and Steel Association as in the accompanying table, in gross tons. Comparisons being made with the results for 1913 and 1914:

	1913		1914		1915	
	Tons	%	Tons	%	Tons	%
Basic openhearth	20,344,626	65.0	16,271,129	69.2	22,308,725	69.4
Acid openhearth	1,255,305	4.0	903,555	3.9	1,370,377	4.3
Bessemer	9,545,706	30.5	6,220,846	26.4	8,287,213	25.8
Crucible	121,226	0.4	89,869	0.4	113,782	0.3
Electric	30,180	0.1	24,009	0.1	69,412	0.2
Miscellaneous	3,831	....	3,622	....	1,527	....
Total	31,300,874	100.0	23,513,030	100.0	32,151,036	100.0

Of the total production last year, 31,284,212 tons was in the form of ingots and 866,824 tons in direct casting. Included in the basic openhearth steel is 1,781,491 tons made by the duplex process; that is partly treated in bessemer converters and finally purified in the openhearth furnace.

The total steel output in 1915 was the largest ever recorded. It was greater than that of 1914 by 8,638,006 tons, or 37.9%, and exceeded the large output of 1913 by 850,162 tons, or 3.6%. The total steel production of the United States first reached 20,000,000 tons in 1905; in the ten years since then it has varied as follows:

1906	23,398,136	1911	23,676,106
1907	23,362,594	1912	31,251,303
1908	14,023,247	1913	31,300,874
1909	23,955,021	1914	23,513,030
1910	26,094,919	1915	32,151,036

From present indications the current year will show a considerable increase.

The production of all kinds of iron and steel rolled into finished forms in 1915 is shown in the accompanying table, in gross tons:

Products	Iron	Steel	Total
Rails	.....	2,204,203	2,204,203
Plates and sheets	20,253	6,057,441	6,077,694
Nail and spike plate	4,984	26,945	31,929
Wire rods	2,236	3,093,671	3,095,907
Structural shapes	1,858	2,435,145	2,437,003
Merchant bars	657,107	3,474,135	4,131,242
Bars for reinforced concrete work	.....	353,408	353,408
Skelp, flue, and pipe iron or steel	262,198	2,037,266	2,299,464
Long angle splice bars, tie-plate bars, etc.	54,678	480,937	535,615
Hoops	300	281,459	281,759
Bands and cotton-ties	200	437,787	437,987
Rolled sheet piling, not including fabricated	.....	24,026	24,026
Railroad ties	.....	42,269	42,269
Rolled forging blooms, forging billets, etc.	570	649,975	650,545
Exports of blooms, billets, sheet bars, etc.	1,231	561,187	562,418
All other finished rolled products	289,218	938,237	1,227,455
Total	1,294,833	23,098,091	24,392,924
Total, 1914	1,167,776	17,202,420	18,370,196
Total, 1913	1,678,257	23,112,986	24,791,243

The increase in the total over 1914 was 6,022,728 tons, or 32.8%. The total, however, has been twice exceeded, in 1912, when it was 24,656,841 tons, and in 1913, with 24,791,243 tons.

The Bulletin gives numerous details of the production, some of the more important being given herewith. Of the structural shapes 2,031,407 tons were heavy sections and 405,596 tons light. Sheets and plates included 954,852 tons universal plates, 1,923,199 tons sheared plates, 1,836,786 tons black sheets and 1,362,857 tons tin-mill sheets. Rolled blooms and billets for forging are included in the table, also blooms, billets and sheet bars sold for export, but not blooms or billets sold to mills in this country to be finished.

Of the total production of rolled forms in 1915, there was 94.7% rolled from steel and 5.3% from iron, against 93.6 and 6.4% in the preceding year.

The production of alloy steel was the largest ever reported, the total in 1915 being 1,021,147 tons, of which 643,791 tons was basic openhearth, 267,353 acid openhearth, 41,111 tons bessemer, 40,948 tons crucible and 27,944 tons electric steel.

During the year there were 134 works making steel ingots, besides a number making steel castings, but not ingots.

Japanese Mining Expansion

Actuated by the greatly increased demand for iron and steel in Japan, the Department of Agriculture and Commerce investigated sources of ore supply. The following is a brief excerpt of the report presented to a committee of the Diet.

The main source of ore supply within the empire proper is the Kamaishi mine, whose deposit of magnetic ore is estimated at 35,000,000 tons. Deposits of similar ore are estimated to total between 5,000,000 and 6,000,000 tons from mines in the provinces of Rikuchu, Echigo, Iwaki, Iwashiro, Kozuke, Yamato, Harima and Mimaska. Deposits of red iron ore, estimated to total about 30,000,000 tons, are located in the provinces of Echigo, Rikuchu, Tosa, Hyogo, Rikuzen and Izumo. Brown iron-ore deposits, believed to total 10,000,000 tons, bring the estimated aggregate total to about 80,000,000 tons for the islands alone.

Continental Asia Iron Deposits

The principal ores of Chosen are the brown and red ores, of which the main deposits are in the region of the Tatung River and are estimated to contain about 10,000,000 tons. Other deposits so far discovered in Chosen are believed to contain not less than 20,000,000 tons, bringing the total for the country to 30,000,000 tons.

In Manchuria various kinds of ore of rather poor quality are known to exist in the region of Anshantien, whose total quantity is estimated at 260,000,000 tons. The famous Penshiho mines produce mainly magnetic iron ore, and the total deposit is estimated at about 80,000,000 tons of good ore.

In China the main iron-producing regions are in the Yangtze Valley, but ore is also known to abound in the Shantung, Shansi, Honan, Kiangsu and Fukien provinces. The largest iron mine in the Yangtze Valley is the Taiyeh, estimated to contain 100,000,000 tons. These Chinese deposits need further exploration to afford bases for estimates of tonnage, and when the investigation is completed it is believed the iron resources will be shown to be vast.

With available resources in iron already known to total 550,000,000 tons, the report to the Japanese Diet comes to the conclusion that while the deposits in Japan are small and insufficient for the development of iron

TABLE 1. IMPORTS OF METALS INTO JAPAN DURING 1915

	1915	1914	1913
Iron and steel, yen	34,419,985	39,933,882	56,763,882
Other metals, yen	20,372,762	11,562,165	14,016,807

Specifications of Some of the Metals Included in the Above Total

	1915		1914		1913	
	M Tons	Yen	M Tons	Yen	M Tons	Yen
Lead	15,682	3,245,457	16,139	3,118,895	15,658	2,817,477
Zinc	8,471	3,137,437	8,201	1,868,853	13,531	3,390,962
Tin	1,195	1,992,651	1,328	2,085,479	1,201	2,377,486
Brass and bronze	.....	1,719,995	.....	450,770	.....	817,863
Nickel	956	1,601,413	1,010	1,592,997	946	1,421,473
Aluminum	488	424,257	481	390,972	311	233,706
"Other Metals"	.....	7,040,400	.....	1,051,503	.....	1,042,833

works which Japan requires, the other supplies are sufficient to justify expansion of the works.

In this connection it will be of interest to append tables compiled from the investigations of the Department of Finance, showing, as they do, Japan's expansion of mining under the stimulus of war-time conditions. [Apparently these tables are somewhat censored.—Editor.] It is interesting to note that imports of metallic iron and steel decreased 22,000 yen in value from 1913 to 1915, or 39%, while simultaneously ore imports increased 29,000 tons, or about 10.4%. Exports of iron and steel are not given.

Imports of all metals other than iron and steel increased in value from 1913 to 1915 over 6,000,000 yen, or 45%, while the value of ore imports advanced from 269,980 yen in 1913 to 2,064,659 yen in 1915, a gain of 664%.

It will be noted that imports of brass and bronze increased in value from 817,863 yen in 1913 to 1,719,995 yen in 1915, a 110% gain. Simultaneously exports of brass and bronze increased in value from 213,080 yen in 1913 to 1,659,522 yen in 1915, a gain of 678%. Apparently the domestic consumption of about 600,000 yen's worth of metal in 1913 decreased in 1915 till the value of the exported and imported metal is nearly equal.

TABLE 2. IMPORTS OF ORES INTO JAPAN DURING 1915

	1915		1914		1913	
	M Tons	Yen	M Tons	Yen	M Tons	Yen
Iron ore	309,174	1,812,311	299,241	1,729,068	280,246	1,585,211
All other ores*	.....	2,064,659	.....	574,374	.....	269,980

*There is no specification given for the item "All other ores," which has been greatly increased during the last year. The advance most probably is due to the large import of antimony-ore from China.

Imports of several metals, possibly including copper, are apparently lumped in Table 1 under the caption, "Other Metals." The value of these, it will be observed, increased from 1,042,833 yen in 1913 to 7,040,400 yen in 1915, a gain of 575%.

Tables 3 and 4, giving Japanese exports, best reflect the rapidly grown war-time prosperity of Japanese mines.

The most significant items of these tables are those relating to metallic copper and antimony, zinc ore and ores of tungsten, manganese, etc. The tonnage of copper ingots exported increased 36%, of antimony 439%, and the value of tungsten, manganese, etc., lumped in Table 4, 900%. Exports of zinc ore, it will be seen, decreased from 27,383 tons in 1913 to 6,128 tons in 1915, a loss of 78%, understood after reference to the brass and bronze figures already given.

TABLE 3. EXPORTS OF METALS FROM JAPAN DURING 1915

	1915		1914		1913	
Copper:	M Tons	Yen	M Tons	Yen	M Tons	Yen
Ingots and slabs.	57,411	44,264,301	44,124	27,196,617	42,136	28,183,904
Plates and sheets	.....	1,445,548	.....	1,028,785	.....	239,586
Wire	.....	453,449	.....	242,211	.....	181,821
Zinc:						
Ingots and slabs.	5,395	3,993,980	.....	.....	.....	.....
Antimony	8,644	7,707,422	4,307	1,117,456	1,602	468,054
Iron tubes	.....	198,924	.....	48,388	.....	67,410
Old iron	.....	253,029	.....	323,011	.....	331,619
Nickel	.....	6,496	.....	15,367	.....	14,942
Brass and Yellow Metal:						
Plates and sheets	.....	1,659,522	.....	245,775	.....	213,080
Wire	.....	256,215	.....	107,286	.....	108,922
All others	.....	3,181,857	.....	724,988	.....	701,281
Totals	.....	63,420,745	.....	31,059,884	.....	30,510,619

TABLE 4. EXPORTS OF ORES FROM JAPAN DURING 1915

	1915		1914		1913	
	M Tons	Yen	M Tons	Yen	M Tons	Yen
Zinc	6,128	360,774	14,155	470,251	27,383	943,271
Tungsten	483	460,042				
Antimony	396	134,182				
Manganese	2,999	161,509	.....	129,043	.....	1,366
Molybdenite	7	55,678				
Others	.....	126,447				
Totals	.....	1,298,632	.....	599,294	.....	944,637

Increased Platinum Production

The production of crude platinum in California and Oregon in 1915, according to the United States Geological Survey, was 741.91 oz., an increase of 171.91 oz. over the output in 1914. California mines produced most of this quantity; only one mine in Oregon reported production in 1915. The Rambler mine, Albany County, Wyo., produced platinum-bearing copper concentrates which were shipped to Eastern refiners. No platinum ore was shipped from the Boss mine, Clark County, Nev.

According to reports received from the platinum refiners, 8,665 oz. of new metals of the platinum group was recovered, of which at least 1,587 oz. is believed to be of domestic origin. Secondary metals derived from the refining of scrap and sweeps to the amount of 42,970 oz. were sold in 1915.

Notwithstanding the embargo placed upon the exportation of platinum by all the allied governments, the United States imports of platinum and allied metals during the year 1915, as compiled by the Bureau of Foreign and Domestic Commerce, Department of Commerce, were only 10% below the 1914 imports, amounting in all to over 69,000 oz.

Figures showing the world's production of platinum and allied metals are at best estimates made from the most reliable information obtainable. The table gives the best estimates from information available at this time:

ESTIMATE OF WORLD'S PRODUCTION OF CRUDE PLATINUM

Country	1912	1913	1914	1915
Borneo and Sumatra	200	200	*	*
Canada	30	50	30	100
Colombia	12,000	15,000	17,500	19,000
New South Wales	778	1,275	1,248	†56
Russia	300,000	250,000	241,200	124,000
United States	721	483	570	742
	313,729	267,008	260,548	143,898

*No basis for estimate. †No figures from Tasmania available at time report goes to press.

Cheaper Gasoline Predicted

Officials of the Standard Oil companies are quoted in the New York "Times" as saying that the worst has passed in the skyrocketing of gasoline prices and that a reduction is to be expected soon. The hope, according to an official who has to do especially with gasoline, is based on two factors: First, that the Standard Oil laboratories have found out how to extract more gasoline from crude oil, and second, that the gasoline-producing quality of much of the oil from the southwestern field is improving.

It was explained that the present high price of gasoline was due to a combination of causes which, it was shown, it was not easy for the layman to comprehend. In the first place, there is the war. Most of the sources of production in Europe are not producing at this time. The Dardanelles being closed, the Allies cannot get gasoline from the Russian fields, and Russia isn't selling it to anyone else. The Russians and Austrians have been battling over the Austrian oil fields, and production is at a standstill there. That makes a large demand upon the American supply.

Again, the German, Austrian and Turkish markets for the byproducts of crude oil other than gasoline are cut off. That makes an over-production of byproducts, the loss of profit on which must be borne in large part by users of gasoline.

Another factor in the great advance which has set the present record price was that, two months or so ago, when the heavy production season was beginning, the production of the Cushing fields in Oklahoma fell almost 50% and what oil continued to flow did not produce the same amount of gasoline as before.

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The Chrome Iron-Ore Situation

Several chrome-ore miners have recently asked the *Journal* for quotations on ore. Other correspondents have required quotations on ferrochrome. In the attempt to satisfy these inquiries a curious state of reticence on the part of consumers, dealers and brokers was encountered. Apparently the larger buyers could not—or possibly would not—furnish the desired information, only three of the smaller buyers out of a dozen showing any disposition to encourage investigation.

Prices of crude ore have advanced considerably since the beginning of the war, which has so seriously disturbed the former condition of water transportation and regular deliveries. If apprehensive is the proper adjective to describe the buyer's state of mind, one need look no further than "Mineral Resources of the United States" for 1915, under "Chromic Iron Ore in 1915," to discover some ground for that feeling.

With the domestic production aggregating 3,281 long tons of crude ore and imports totaling 76,455 tons, the apparent consumption was 79,736 tons. No statistics are available to show the distribution among the tool-steel, armor-plate and projectile manufacturers, the brick makers, and the chemical manufacturers of bichromates of soda and potash. Some of the ore brokers interviewed, as stated, claimed—and their claim is here merely recorded—that the ore consumption in the brick industry constitutes the big end of the business. The United States Geological Survey's report merely states that the price of brick fluctuated during 1915 from $50 to $90 per thousand for standard sizes. It states that there was a continuous advance in the price of bichromates due to the unprecedented demand for the American products growing out of war conditions. The foreign demand is large as is also the domestic demand in the textile industry on account of the lack of German dyes and the consequent growth of our infant dye industry.

The point is that the ore producer knows of these advances in price and doubtless believes he is as much entitled to a share in the war profits as the more fortunate producers of tungsten ores, hence the present spectacle of the ore producers holding back for higher prices.

Apprehension on the part of ore brokers and consumers, and their consequently assumed air of mystery, is probably due in a large part to the uncertainty and irregularity of deliveries of foreign ores. Of the 76,455 tons of crude ore imported in 1915, only the 10,087 tons produced in Quebec, Canada, were shipped from a port comparatively near the eastern waterfront of the United States. Of the remainder, New Caledonia and other points of French Oceania shipped 28,031 tons, while nearly all the rest came from Africa—22,800 tons from British South Africa and 11,230 tons from Portuguese Africa—the only other notable shipment, of 4,305 tons, coming from Greece. The latter is apparently not seriously embarrassed by the blockade of the Allies, since one of the largest manufacturers of chrome brick reports expecting a shipment of ore "sometime in four or five weeks." We understand that the bulk of the ore imported comes in sailing vessels, which doubtless means that it is ballast on the return voyages.

One of the former conditions adversely affecting the development of American mines was the freight rates between California and the Atlantic States. With the former rates of $13.60 to $15 per ton reduced to $11 per ton since Jan. 11, 1916, however, the California and other Western producers are now on a better footing to compete with foreigners in the Eastern market. The beneficial effect of this freight reduction on the American producers is readily seen in the fact that California, since recent months, is no longer the sole state producing any appreciable quantity, ore from Grants Pass and Riddle, Ore., having recently appeared on the market.

With war-time conditions demanding the greater part of the ores mined in New Caledonia and Rhodesia for France and England, a brisk demand for the Quebec product in the United States sprang up during the last six months of 1915. The Quebec deposits are said to be considerably smaller and more pockety than those of California, the average grade of the latter running 40 to 50% as compared with about 30% for the Canadian product. Freight rates from Black Lake, Quebec, to Perth Amboy, N. J., are about $3.15 per ton, as compared with the rate of $11 from California.

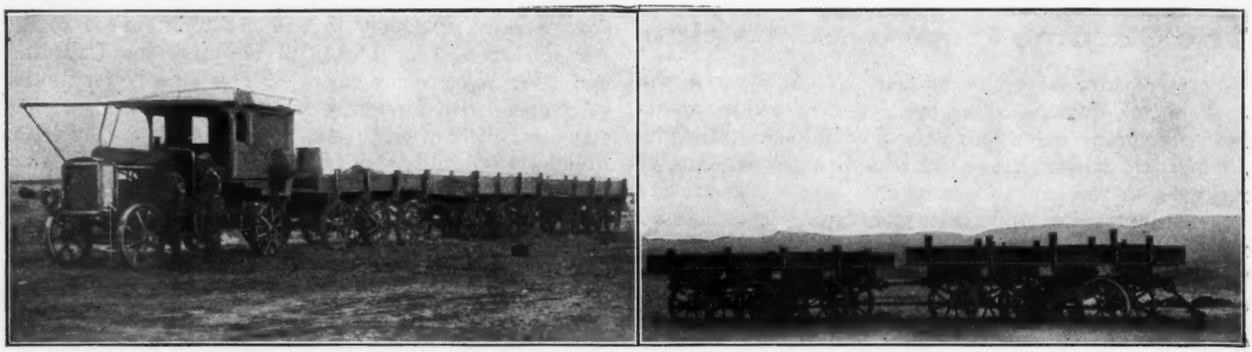
The average price of chromite in 1915 was about $18 per ton at Ontario points. On the Pacific coast 1915 prices ranged from $11 to $18 per ton f.o.b. point of shipment for 50% ore. An additional 50c. per ton for each per cent. over 50 was allowed.

Situation of American Operators

With foreign deliveries of crude ore uncertain and water freights subject to considerable variation due to war's vicissitudes, the Western ore producers should become more important in the market so soon as their mine developments allow them to reach the point of cheap mining. Obviously it would be a far-sighted policy on the part of the consumers to encourage all possible development by allowing prices justified by the times and increased profits on the finished articles. Spasmodic buying from Americans, at widely varying prices and only at times when forced by failure of foreign deliveries, can hardly be expected to benignly affect the domestic business. In other words, the Americans "hold the bag" on any such procedure.

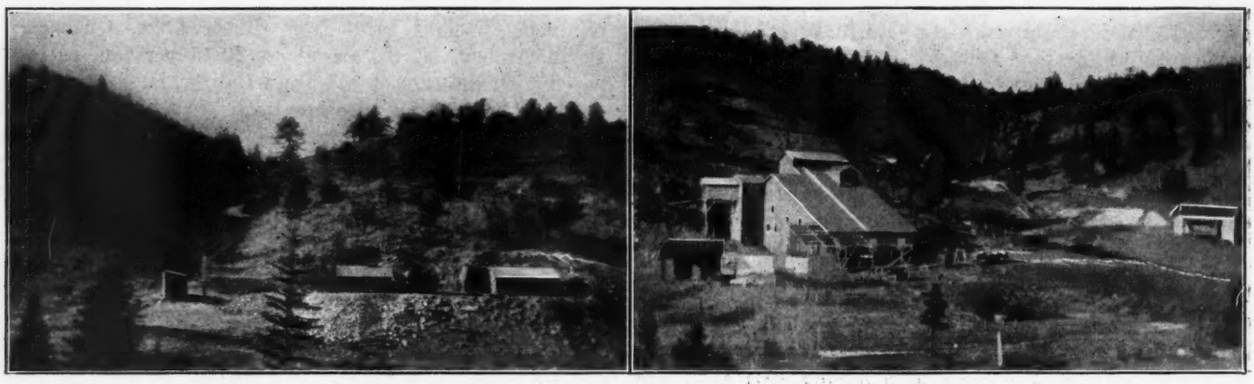
Eastern prices are now said to range from $25 to $35 per ton for 50% chromic-acid ore, in full cargoes of about 7,500 tons. As a matter of fact, these are the prices that prevailed throughout 1915. It is easy to suspect, therefore, that mystery on the part of the buyers, in refusing to give quotations, cloaks an occasional willingness to increase prices to domestic producers—whenever forced to by nondelivery of expected foreign shipment. A more liberal policy patterned after that of the tungsten buyers would doubtless result in a more rapid development of the American chrome-iron mines, swiftly resulting in cheaper mining and greater stability to the market. Few American industries have ever profited in the long run from a policy of mystery and silence. Greater publicity would certainly result in a better understanding by all parties concerned.

Photographs from the Field

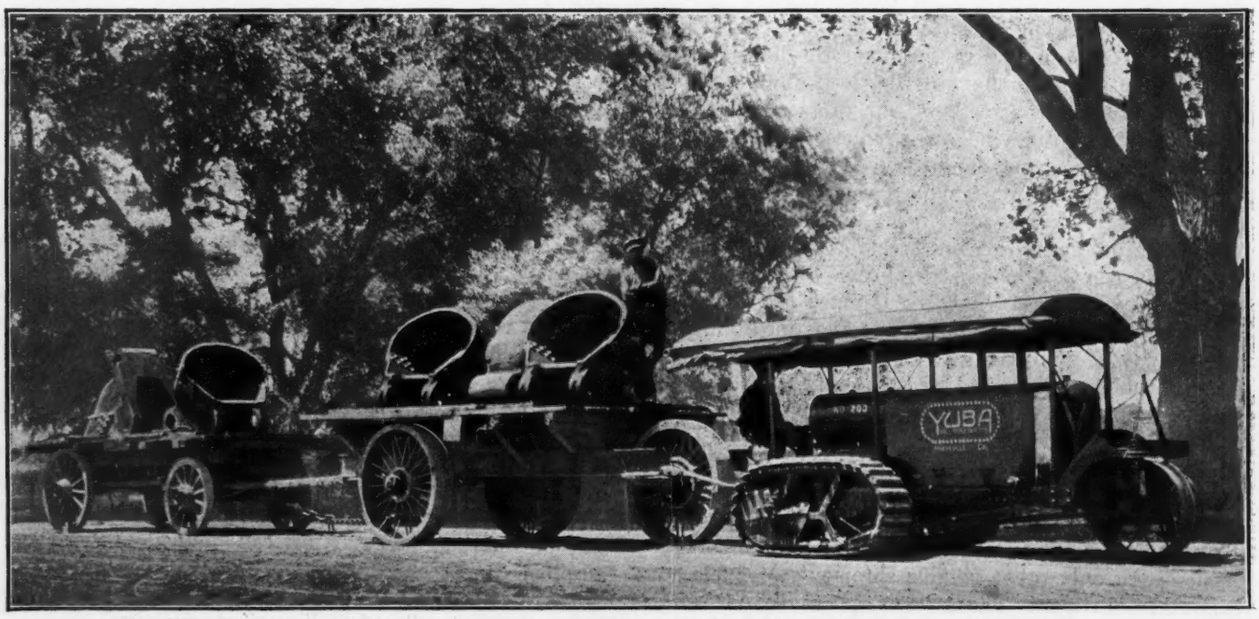


WHITTALL TRANSPORTATION SYSTEM USED IN DEATH VALLEY, CALIFORNIA

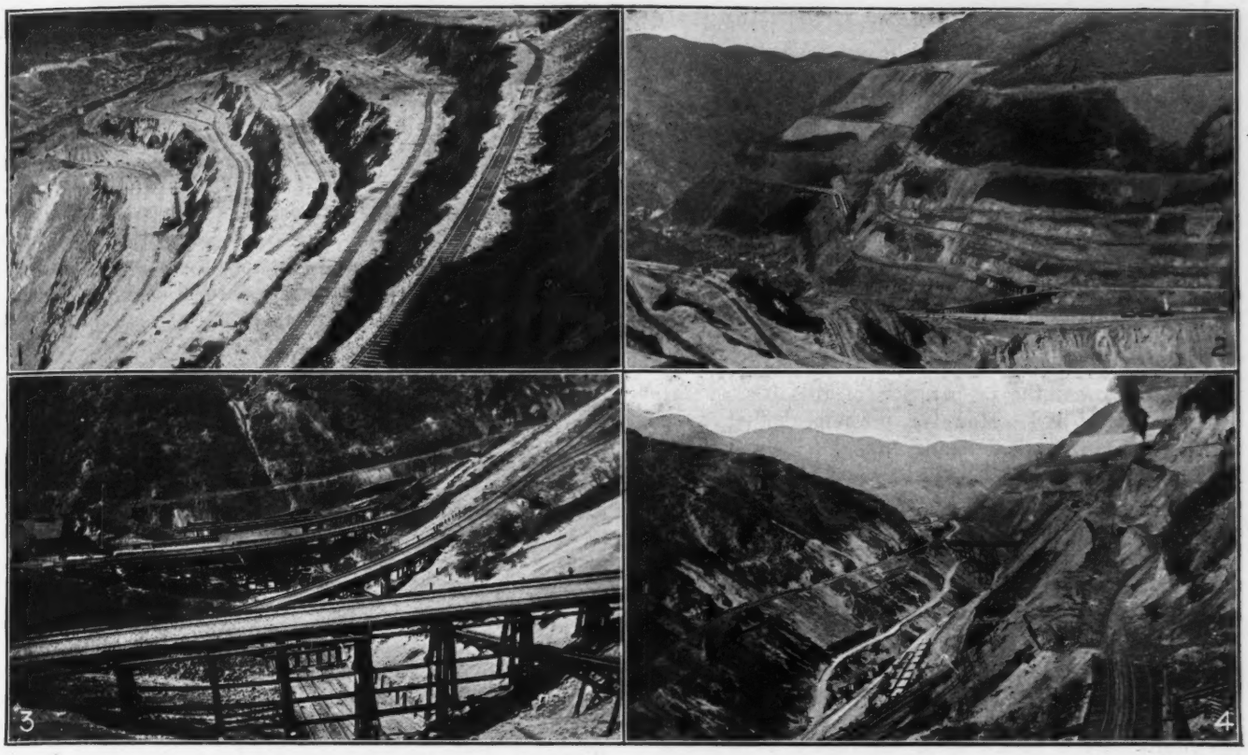
In this system, the power is generated in the leading truck and transmitted by a shaft extending throughout the train, each wagon thus being positively driven



THE BOULDER TUNGSTEN PRODUCTION CO.'S PROPERTY IN BOULDER CO., COLO., SHOWING THE PORTAL OF THE NEW ADIT AND THE MILL NOW IN OPERATION



MODEL 18 YUBA TRACTOR HAULING THE LARGE BUCKETS FOR NEW YUBA DREDGE



VIEWS OF THE OPERATIONS OF THE UTAH COPPER CO., BINGHAM CAÑON, UTAH

Practically all equipment is working at one-third over its rated capacity. To mine and transport this ore, 107 mi. of track have been laid, 57 of which are at the mine

EXCAVATIONS FOR MILL OF UNITED EASTERN MINING CO., OATMAN, ARIZ.—SHAFT HEAD IN BACKGROUND

Correspondence and Discussion

Microscopical Study of Ores

The comment in the editorial section of the *Journal* of June 17 regarding the recent book by Dr. Joseph Murdoch on "Microscopical Determination of the Opaque Minerals" is, on the whole, so favorable and sympathetic that complaint would be quite unfitting, even from one who has followed the preparation of this book with so deep an interest as I. However, the remark that, as contrasted to use in skilled hands, "the novice will find all kinds of pitfalls and his conclusions as to genetic relations of minerals may prove valueless" seems to me to call for comment.

It is possibly true that we who are now so thoroughly accustomed to the methods presented in the book may have underestimated the difficulties in using them that may be experienced by others. As to that, discussion would be idle, since time alone will afford the answer. But it should be noted that the claim to simplicity that I made for the book in its preface extends not farther than the limits of the book's scope, in regard to which the concluding phrase quoted above might convey an impression quite misleading.

The single and sole object of this book is the identification of the opaque minerals, and with unimportant exceptions only such matter is included, on topics like preparation of the material and methods of examination, as is essential to proper application of the scheme of identification proposed. Discussion of genetic relationships, geological significance and modes of occurrence of the minerals has purposely been avoided, partly because the establishment of a scheme of identification was in itself a sufficient task and partly because knowledge regarding these other matters is not yet sufficiently extensive or firm to justify a contribution concerning them of any such formality and pretentions as a textbook.

Without doubt some users of Murdoch's book will draw false or valueless conclusions as to the genetic relations of the minerals they may be investigating, but it will hardly be maintained that these conclusions are more likely to be erroneous after the minerals involved have been accurately determined than when their identity was a matter of more or less guesswork; on the contrary, deductions are likely to be much more reliable if based on exact knowledge of the units that constitute the problem; namely, the minerals of the ore. The possible implication that this may be a dangerous book to put in the hands of beginners resembles the fear that use of a dictionary may lead to incorrect speech because it deals only with words and not with the construction of sentences or paragraphs.

To the suggestion that microscopic examination of the ore minerals should be accompanied by similar study of the associated gangue minerals I assent wholeheartedly, though tempted in this conection to ask what could be done had not Sorby, Michel-Levy, Rosenbusch and others provided realiable means for identification of the transparent varieties under the microscope. I fear I must agree, also, with the view that the literature of this relatively new science of mineralography, or microscopical study of the ore minerals, holds an unfortunate proportion of contradictions, misconceptions and trivialities. Yet such shortcomings are inevitable in any new field of research and in this particular subject, at least, are to be attributed rather to the sudden appeal and fascination it has exerted upon students and investigators, especially of the younger generation, than to any inherent lack of reliability and value in the subject itself. With time and sincere, careful effort, false byways of the present will be first revealed in their true light and then obliterated, but it is hardly to be doubted that, though they may have temporarily delayed direct progress, they will have stimulated the development of substantial avenues leading toward the true goal. In any case means for accurate determination of the mineral species cannot fail to be helpful.

Perhaps I may be permitted to add the conviction that if all students of mineralography were to observe a restraint similar to that practiced by Dr. Murdoch, who worked steadily on his one subject for four years before entrusting his results to print, there might be less occasion for criticism and correction, and less justification for the distrust with which some unfortunately now regard this truly valuable method of investigation.

Cambridge, Mass., June 23, 1916. L. C. GRATON.

Preparedness

The editorial entitled "The Scarcity of Ships" calls attention to our lack of shipping facilities with which to carry on and increase our trade with the South American countries. Before the war there was greater European trade than North American. In Argentine Europe was much better known than the United States. Ten travelers went to Europe where one went to North America. The war stopped the operation of the principal line of steamers, the Hamburg-South American line, and those Argentinos and Brazilians who had heretofore gone to Europe turned to this country for their travel and studies. The trade between the United States and the East Coast increased.

Recently the Argentine government has made new laws that greatly favor the investment of foreign capital there and should be of great assistance to those American mining men who have given up in disgust the attempt to develop the mineral resources of the eastern slope of the Andes. The English law regarding the investment of English capital outside of the Empire further removes England from the field of competition. Conditions look favorable toward the development of American industry and mining in Argentine.

Americans realize that the mutual trade relations are strengthening, but do they realize that there are others in the field of competition? The Argentinos, while perfectly friendly to North Americans, are also perfectly friendly to any foreigner who will develop their country honestly. I know of several instances where prominent bank officials have sent their sons to North American

banks for periods of several years to learn the language and banking customs and then have given them responsible positions upon their return home. They are doing their share toward inter-American trade. But they are doing the same in England and until recently in Germany. Are we making an equal effort to further these conditions?

I have just been talking with a person fresh from a visit to the prison camps in England, France and Germany. I have had a hazy impression of life in a prison camp as being spent by the Germans in smoking and drinking beer, where available, by the English in playing cricket and by the French in drinking wine and making curios. This, however, is not the case. In all the camps a goodly portion of the men were engaged in study. Their books were on many topics; history, geography, political economy and languages—all received attention. The majority of the language texts were Spanish. Spanish is the language of Argentine.

If Europe in time of war can prepare for peace, can't America in time of peace prepare for continued peace and increased trade relations? How many Americans now are looking forward to trade relations with Argentine during the next decade? How many of these know Spanish and the laws, history and customs of that land? How many of those who don't are making any effort to? Argentinos are coming halfway to meet foreigners, be they English, French, German or American. English, French and German are preparing to meet them halfway. Are Americans doing their part to be in the lead?

A short time spent daily on the study of Spanish I feel would amply repay the average mining engineer within the next decade. F. W. FREDERICKS.

New York City, June 20, 1916.

Misuse of Belt Dressing

With reference to the article on "Misuse of Belt Dressing," in the *Journal* of May 13, 1916, p. 858, I agree with the writer in some respects, but not in all. When he says, "The use of belt dressing should be abolished because it is unsafe, unnecessary and wasteful," I disagree with him in every point. The use of belt dressing is not unsafe, unless practiced unsafely. Dressings need not be applied when a belt is in motion; even if so applied, with a stick at the end of which is a pad saturated with the dressing, there is absolutely no danger, especially if the beltman puts on the dressing at the point where the belt leaves the pulley—not where it approaches it.

The use of belt dressing is not unnecessary. For the same reason that machinery needs oil, a belt needs a certain amount of lubricant. In other words, a belt needs dressing. It is possible to run belts dry, without dressing, but it has been proved that belts treated with a proper dressing will last longer, pull greater loads and give greater efficiency.

Dressings are not wasteful. The following instance, among many will illustrate this point: An old 12-in. leather belt in the Union dry dock (Erie R.R., Buffalo, N. Y.) was first treated in 1896. By its use it was possible to add several new machines to the belt's load. It is figured that $63 was spent for belt dressing, but the treatment of this one belt was worth $640.

As for efficiency and pulling qualities of dressed vs. undressed belts, I need only refer to tests that have been made in the laboratories of Cornell University under the supervision of Prof. R. C. Carpenter. I personally assisted Robert Thurston Kent in making another series of tests on treated vs. untreated belts. The later tests were static. The former were on belts in motion. The reason belting manufacturers do not recommend belt dressings is that most of them make a brand of their own that they do not call a dressing. They call it a "light oil to keep the belts soft and pliable," as Mr. Prescott says. That is just what a good dressing should do. That is what F. R. Taylor recommended for belts and what all authorities recommend. Clean belts, clean pulleys and freedom from dust are all highly desirable in belt drives. They are obtainable with the proper dressing. I would therefore recommend the proper dressing rather than advise the complete elimination of all kinds of dressings.

New York, June 20, 1916 N. G. NEAR.

Americanizing British Mines

My attention has been called to the résumé in the *Journal* of May 13, 1916, of an article "Americanizing British Mines," published in the *Financial Times* of London. I have not yet seen either of the original articles, but I should certainly like to disassociate myself from any such imputations as British engineers are charged with. The solidarity of the mining profession as a whole is one of its brightest features, and as far as I know, there is little if any jealousy existing between British and American engineers, who take pride, on both sides, in the achievements and success of their professional friends and colleagues. I quite agree with your remark, that "right-minded men do not consider engineering ability in terms of nationality," although they naturally take a broad British-Imperial view of their obligations on the one side and an American view, no doubt, on the other side of the Atlantic; in each seeking to uphold the prestige and interests of their own country.

The question whether we are reaping the fruits of short-sightedness in not having turned out more mining engineers and metallurgists from our schools, seems to me, however, to be open to some question. The point of view from which I look at the matter myself is that it is a pure waste of time and valuable energy to educate—at great expense—a larger number of young men for any particular profession that there are suitable openings for them to fill; and it is extremely doubtful whether at the present time—whatever may be the state of the case later on—the mining profession is not a bit overcrowded.

Prior to the reorganization of the Royal School of Mines (with which, by the way, the name of an American engineer, Hennen Jennings, must always be gratefully and prominently associated) America doubtless got the lead of us in education. A. G. CHARLETON.

London, June 16, 1916.

Tacitus, the Historian

In the department "By the Way" in the *Journal* of May 27, you give my ancient friend Tacitus, the historian, a little greater antiquity than he is entitled to. Instead of writing "Some time in the B.C.'s," as you have it, he was born in the reign of Claudius Caesar, about 53 A.D. and his "History" from which the quotation was taken was written in the reign of Nerva or Trajan.

Patton, Calif., June 6, 1916. LOUIS JANIN, JR.

Editorials

The Proposed Tax on Copper

In commenting last week upon the proposed Federal tax on copper, we did not have the text of the measure before us and therefore had to be cautious. It was inconceivable to us at that time that copper alone among the metals should be taxed, yet mention of no other was made in the press dispatches. However, they prove to be correct. Out of the entire long list of crude commodities copper is singled for special taxation!

That Congress should have such a conception is dumfounding. Why copper and why not iron, lead, zinc and the rest? Why not coal and petroleum? Why not wool, leather, wheat, corn and cotton? The one thing that baldly stands out is the unfairness of this project. Here we have class legislation with a vengeance. Copper producers are right in standing aghast at the enormity of the idea.

But this is not the worst of it. The proposed act reads, "Every person smelting copper ore, refining metallic copper or alloying copper shall pay . . . an excise tax . . . (on) the gross receipts . . . from the sale or disposition of refined copper or copper alloys and from the sale or disposition of crude or unrefined copper if sold or disposed of for any purpose except for refining or alloying."

We interpret this as meaning that the miner does not have to pay anything unless he smelts and refines. The smelter does not have to pay anything unless he sells his pig copper for casting purposes. The refiner has to pay (of course he will throw back upon the smelter) and the brass maker has to pay again for the refined copper that he uses. If the profit be less than 10%, nobody has to pay. This lets out the careless, little fellow. Of course it is only the small class of big fellows at whom Congress in its present spirit is aiming. The thing is bungling and monstrous.

Alas! Class legislation is the governing idea in the new revenue bill as a whole. The income tax is doubled in rate without there being any reduction in the exemption limit. This tax is thus kept distinctly as a class tax. It falls upon a very small percentage of the population of the country and chiefly upon the people of a few states. The proposed tax on copper is even more narrowly limited. There is talk among the producers of spreading it among consumers generally, but how is that going to be done when half of our copper production must be sold in foreign markets in competition with the copper of the rest of the world?

We find no fault with the principle that taxes must be raised. We advocate military preparedness, and that is going to cost money, which must be supplied by the people, but let them do it on a basis of equality. We do find fault with plans for unequal taxation, for class taxation, that are made the cloak for all kinds of governmental extravagance. We grumble about a tax on copper to provide money to build marble post offices in Yahoo and shack-towns and to dredge creeks in the prairies. We object to the expenditure of public money to maintain and aggrandize the jobberies—the bureaus—in Washington that spend vast sums to prepare bulletins gravely to inform us that the Dutch have taken Holland, to print the mouthings of quasi statesmen at enormous expense and to carry on a variety of enterprises that broach upon the scandalous.

Now that Congress has learned how easy it is not only to spend other people's money, but also to get it, how long is it going to be before the income tax is quintupled and a tax on copper is levied and quadrupled? And what is going to be the economic result if the earnings of profitable industry be sucked away to be wasted?

This copper tax may not be felt so keenly when copper is above 20c. as it will at the normal of about 15c. and under. Consider a producer whose cost is 12c. and whose output is 67,000,000 lb. at 15c. Gross output, $10,050,000; net output, $2,010,000; excise tax, $191,500; rate, 9½%. When the price for copper gets down to 14c., the determination of the 10% profit under the clause that grants exemption will begin to be interesting.

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Origin of Mississippi Lead and Zinc Deposits

The zinc and lead deposits of the Mississippi Valley are simple in their structural relations and in their mineralogical composition. Nevertheless the most divergent views as to their genesis have been expressed, and the literature dealing with them is exceptionally voluminous. During the last 20 years the dominant views attribute these ore deposits to the action of surface waters, but there are two camps of geologists opposing each other as to the manner of operation of these waters.

Buckley and Buehler, both well qualified to judge, hold regarding the Joplin region that the ores have been leached by descending waters from the Pennsylvania shale and deposited by reaction between descending and ascending waters. Van Hise, Bain, Tangier Smith and Siebenthal, representing the United States Geological Survey, believe the zinc ores were leached from underlying strata by ascending waters and that they were deposited near the impervious cover of the shale. Other authors—for instance, F. L. Nason and W. P. Jenney—have not hesitated to look for the source of the metals in the underlying pre-Cambrian crystalline rocks, and once in a while other observers, noting the evidence of an epoch of brief but intense deposition, venture to advance the view that these deposits, usually considered free from magmatic taint, have in fact been formed by attenuated solutions rising from deep intrusions. J. E. Spurr suggested this for the lead deposits of southeastern Missouri, L. V. Pirsson recently suggested the same in regard to these deposits in general, and W. L. Uglow finds corroboration of this view in some Canadian occurrences, all of these articles appearing in *Economic Geology*.

The most noteworthy contribution to this much-debated question is found in Siebenthal's recent bulletin on the "Origin of the Joplin Deposits." Unquestionably his results mark a great advance in our knowledge, and the theory of deposition by ascending saline-alkaline waters more or less charged with carbon dioxide and hydrogen sulphide has received the strongest kind of support. Siebenthal elucidates convincingly the artesian circulation of the region, shows the importance of the impermeable barriers of the Devonian and Pennsylvanian shales, indicates the probability of derivation of the metals from the Cambro-Silurian strata and points out how the dissolved zinc bicarbonate is held in solution by the carbon dioxide in spite of the presence of hydrogen sulphide until the former gas escapes.

Even more important than this is the definite proof furnished that the ascending waters of the region, where tapped by artesian wells, contain iron, zinc, lead and copper in solution, which metals are precipitated in reservoirs and tanks as a black slimy deposit of sulphides. It is shown that a metal content of such waters is not confined to the Joplin region, but also is present in other regions of the great interior valley. This discovery is one of the most important contributions in recent years to the knowledge of this class of ore deposits.

Copper and Spelter Decline

The decline in the prices for copper and zinc have produced the usual dissatisfaction, although the level for each of these metals is still very high, especially of copper. Some people deceive themselves by refusing to admit that there has been any decline, or offer the excuse that the decline has been on very small business and comfort themselves with the belief that no considerable quantity of metal can be obtained at the prices quoted.

A cataclysmic decline usually happens on very small sales. When in 1907 copper fell from about 25c. to below 12c., the sales on the way down were relatively trifling and the volume of business did not attain large proportions until the bottom had been reached. We are not looking for any such decline in copper now as happened in 1907. There was lately some large business pending, which failed to be consummated owing to inability of buyers and sellers to agree upon price.

It is really a pity that the establishment of prices has to be a matter of trading. There ought to be some means of enabling spelter producers to take consumers by the scruff of the neck and compel them to pay 15c. per lb. for the average output. But so long as buyers are independent and will not buy unless they want to, what can be done?

The Readjustment

Reports are becoming more and more frequent of concerns that have completed their foreign orders for shells, shrapnel and other ammunition and are not only receiving no new orders, but do not want them. Some of these concerns say they do not want to bother with any more war orders, and others report that they are so busy with manufacturing for domestic peaceful purposes that they would not take any more ammunition business anyhow. One inference to be drawn from this is that the European governments have now organized their industries so that they are able to produce their own supply of ammunition; another is that American industry is returning to its normal basis. We are now going through a period of readjustment. The tension has been relieved, the excitement has disappeared, but domestic business is proceeding at a high rate and probably will continue to do so for a long time to come. Although we shall be supplying Europe with fewer shells and less explosives, our raw material and many of our manufactures will still be required in quantities as large as heretofore. For example, Great Britain and France may now be able to make their own ammunition, but they will have to buy American copper just as they have been doing.

The recent slackness in copper and lead and the small recession in the prices for those metals simply reflect this readjustment. At a little lower, but still very remunerative level, there will probably be a revival of business. The matter of spelter is of course different, for the excessive price for that metal so stimulated new production and diminshed peaceful consumption that a different kind of readjustment is in prospect.

The Mexican imbroglio seems to have been cleared up for the time being. Carranza has become as sweet as sugar, notifying the Washington Government of the approach of bandits toward the border, urging the American authorities to head them off and offering assistance to do so. In the meanwhile appeals are being addressed to American mining men to please come back and reopen their mines and metallurgical works. Whence, forsooth, is there going to be any income for the Mexican government if mines and oil wells do not produce? Thus we have a temporary adjustment of affairs, with our troops guarding our border, but if we know Mexican conditions, it will not be long ere new outrages are perpetrated that will again command our popular attention and lead to the intervention which is the only thing that will put the Mexican house in order.

The arrival of the German commercial submarine "Deutschland," which surprised us last Sunday, has produced new complications in diplomacy, although in principle she is nothing but a successful blockade-runner, the escape of which in no wise invalidates the British blockade of Germany. The "Deutschland" brought a cargo of dyestuffs, which is the most concentrated salable commodity that Germany offers. It will be more interesting to learn what sort of a cargo she will try to take back. Will it be copper, nickel, rubber, or something else? An inkling may be obtained from her manifest as to what Germany needs most.

The idea that prevails in the British Empire that the boosting of the price for spelter was a German plot to make the Allies pay highly for an essential commodity may now be set against the idea prevalent in the United States that the recent slump in spelter is the result of British manipulation to force the American producer to sell cheaply. One idea is as sensible as the other.

BY THE WAY

The applicant for the position was asked by the business man if he had a college diploma. According to *Puck,* the applicant replied: "No sir, but I have several mining-stock certificates that might be offered in evidence that I have been through the school of experience."

In August, 1914, 200 mechanics of the gold mines of the Transvaal proceeded to England to undertake munition work; these volunteers were provided with free return passage and their billets are guaranteed to them on their return. They have given an excellent account of themselves.

Some years ago the citizens of a county in a Western State in a burst of enthusiasm constructed a 100-mile railway, according to *Engineering and Contracting.* In due course of time an attempt was made to unload the property on Eastern capitalists. They sent out an engineer to investigate. He reported that the railway had been built either 100 miles too long or 100 years too soon.

Dispatches from Rome announce that a violent earthquake on July 6 caused the loss of many lives, variously estimated at from 100 to 300, in the sulphur mines of the district of Caltanissetta, Sicily. It is stated that the victims were in three sulphur mines, which the earthquake caused to cave in. This is the only instance, which we can recall, of an important mine disaster resulting from an earthquake.

"Smoke farming" and the like do not always pay. With war prices prevailing for potash for two years, the orange growers in southern California are just beginning to realize what a handsome thing the Riverside cement company was doing for them in letting its potash-containing dust fall on the near-by orange groves. All they needed to have done was to "hose down" the trees and they would have had their potash delivered on the ground for practically nothing, instead of the prohibitive $300 to $500 per ton when bought in the market. The orange grower's complaint about the cement-plant dust became so serious that the company endeavored to buy up near-by groves at $1,000 or so an acre, but the suits and threatened injunctions from outlying groves continued, and so the cement company put in a Cottrell precipitation plant. The company is reported to have recovered last year potash which was sold for approximately $100,000.

The prospectus of the Virginia Mines Development Co., Inc., indicates new possibilities in the mining and metallurgical field. Virginia, once the mineral treasure house of the United States, is again called upon—this time for the modest sum of $15,000,000 gold and substantial quantities of platinum. "The development through tunnels, drifts and stopes has proceeded sufficiently to warrant estimates by the mining engineers of the company that from less than one-third of this zone and down to the 500-ft. level only, the recoverable values should reach upward of $15,000,000." Geologically the report continues: "The ore formation is of slate and schist which has been eroded down to the present levels. The eroded material forms placer beds in which numerous gold-bearing veins and schists occur." "Selections made without special care show an average gold content of $51.88 per ton." Mining and metallurgical efficiency will evidently be high, since but $2 per ton is allowed for both these factors. A 500-ton cyanide plant, its initial cost in the neighborhood of $500,000, is assumed. A dividend of $12 per share is suggested for a period of 16 years as an inducement to the purchase of stock. This large ore-body is assumed to be in Goochland County, Va.—some proposition!

Dr. Miller Reese Hutchison, chief engineer for Thomas A. Edison and himself an inventor, has given to the New York *Times* his own experience in the matter of motor-fuel substitutes which make him inclined to be skeptical of "green gasoline," the cent-a-gallon substitute for real gasoline, a discovery of Louis Enricht, of Farmingdale, L. I., which was erroneously reported to have been bought by the Maxim Munitions Corporation Co.

"Here is the story of an inventor I repeated to Hudson Maxim when he asked me what I thought of the whole thing," said Dr. Hutchison. "I received a message asking me to get over to the Navy Yard in Brooklyn as fast as I could to see a new invention which was going to revolutionize the whole theory of gasoline motor-fuel. It seems that a man had made a discovery, persuaded Washington to allow him to try it out in the navy yard, and it was the day of the experiment. When I got to Brooklyn I found a little group of naval officers and a few engineers gathered about to watch a civilian undertake to run a gasoline engine with a mixture which he said was plain water and a certain simple chemical.

Every precaution was taken to guard against any sort of fraud. The man took about two gallons of pure water, then poured in a tube of his 'discovery,' put the mixture in the engine, cranked up and away she went. I tell you it got all our goats to see the wheel spin and hear the exhaust, realizing it was nothing but water which was presumably burning in the cylinders. I was so much interested that I set to work in my own laboratory that night to see if I could get any idea of just what I had witnessed that day. I had smelled the exhaust to be sure that the engine was not burning gasoline, and that gave me the idea that an acetylene solution must have been used." Dr. Hutchison rigged up a contrivance from an automobile gas-lighting tank. He found that by using acetone to take up the acetylene and then dissolving the acetone in water he had a mixture which he believed would do. The next day he went back to the navy yard, poured his solution into some water and put it into the same engine. It started with the first cranking and went just as it had on the previous day.

"You see," said Dr. Hutchison, "the water in each case was merely the vehicle to get the explosive into the cylinders. There was nothing taken from it or added. It was as if a man took the ashes from his furnace and saturated them with oil. They would burn, but then the ashes would be left as before, and unless you put in some more oil you could not get another fire out of them."

Dr. Hutchison was asked if what he had discovered was not a substitute for gasoline. "Why, yes," he said; "so is picric acid, for that matter, but you should have seen those cylinders when our experiment was over."

Mining Law Revision

At the meeting of the Alaska Mining and Engineering Society at Juneau, Alaska, on May 20, the subjoined resolutions were adopted.

Whereas, A serious endeavor has been made to correct defects in the 50-year-old mineral-land laws of the United States and Alaska, in order that they will be in harmony with the various changes resulting from the general advancement in the mineral industry and can therefore adequately meet present-day requirements; and

Whereas, Various professional and scientific organizations, such as the American Institute of Mining Engineers, the American Mining Congress, the Mining and Metallurgical Society, the Idaho State Mining Association, the Montana Society of Engineers, the California Metal Producers' Association, the Spokane Mining Men's Club, the Nevada Mine Operators' Association, the Colorado Scientific Society, together with representatives from several chambers of commerce and from operating mines, have harmoniously united in an effort to secure the passage of a bill by Congress "to provide a commission to codify and suggest amendments to the general mining laws"; and

Whereas, There appeared before the Committee on Mines and Mining of the House of Representatives engineers from the above organizations, acting as authorized delegates, and who command the respect and confidence of their respective societies, and whose motives, honesty and sincerity of purpose are not to be questioned; and

Whereas, The Hon. James Wickersham, Delegate from Alaska, who also appeared before the House Committee on Mines and Mining, chose to attack the personalities of these engineers, as well as their honesty and motives, and through his abuse and ribaldry brought the people of Alaska into ridicule and contempt; now, therefore, be it

Resolved, That the Alaska Mining and Engineering Society assembled at Juneau go on record as expressing its earnest disapproval of the tactics adopted by the Hon. James Wickersham, and to express also a feeling of humiliation at being represented in Congress by one whose chief method of argument against the bill was personal abuse.

Resolved, That we, as engineers of Alaska, are convinced that the efforts of the engineers appearing before the House were honest and sincere and that the passage of the bill would have resulted in good, not only for the entire country, but for Alaska in particular.

Resolved, That it is the sense of the Alaska Mining and Engineering Society that the House committee made a grave mistake in failing to act favorably upon the bill, as to the best of our judgment a commission organized as provided by the bill will be the most efficient and prompt means of revising the mining laws beneficially.

Resolved, That due publicity be given to these resolutions and that they be sent forthwith to the various societies, engineering papers and public officials chiefly concerned.

The mining men of Alaska and in the Northwestern States, especially, are taking great interest in the matter of mining-law revision.

The secretary of the Mining and Metallurgical Society of America has issued the following letter:

The most important work before the society at the present time is that of securing certain alterations in the Federal land laws as they affect mineral locations.

The attempt made at various times to secure a congressional commission to investigate the subject and to make recommendations to Congress, culminating in the strongest possible presentation to Congress last winter by a combination of American organizations interested in mining, failed to secure the desired result.

It is now the belief of our representatives in Washington that the changes can be secured only by presenting to Congress a bill which shall embody the changes desired.

Acting on this belief, a set of specific recommendations was introduced and discussed at the meeting of the New York Section on Apr. 19. The recommendations and the discussion were published in Bulletin No. 96.

Copies of the recommendations have been sent to all organizations that have shown any interest in the subject, and they are now receiving consideration by these organizations.

Communications should be addressed to Mr. H. V. Winchell, chairman of the Mining Law Committee, 505 Palace Building, Minneapolis, Minn., or to the secretary of the society, 115 Broadway, New York.

Foreign Trade in Copper

Exports of copper from the United States in May and the five months ended May 31 are reported by the Department of Commerce as below, in pounds:

	May	Five Months
Ore and concentrates, contents	356,547	1,611,507
Blister and black copper	.....	3,015,015
Refined—ingots, bars, etc	71,620,384	278,882,117
Plates and sheets	572,316	6,752,603
Wire	1,952,143	9,730,118
Old and scrap	7,866	35,928
Total copper, lb	74,509,256	300,027,288
Copper manufactures, value	$1,656,843	$6,381,295

The weight of ore exported in May was 8,728 tons; of concentrates, 418 tons; showing an average of 36.4 lb. copper to the ton of ore and 93.5 lb. copper to the ton of concentrates.

Imports of copper into the United States in May and the five months ended May 31 are reported by the Department of Commerce as below, in pounds:

	May	Five Months
Ore and concentrates, contents	13,404,142	62,106,537
Matte, contents	1,294,414	9,677,561
Unrefined—blister copper, etc	22,744,599	117,323,903
Refined—bars, plates, etc	7,902	2,506,392
Composition, copper chief value	165,907	399,041
Old and scrap	901,011	4,492,824
Total copper, lb	38,517,975	196,506,258
Copper manufactures, value	$2,157	$17,965

Actual tonnage of copper-bearing material imported in May was 50,946 tons ore, 10,577 tons concentrates and 1,621 tons matte. Net exports of copper in all forms were 103,521,030 lb. for the five months.

Brunswick Consolidated Headframe

At the Brunswick Consolidated mine, Grass Valley, Calif., a new headframe 85 ft. in height from the collar of the shaft to the center line of the sheaves, was erected during 1915. It is all steel excepting guide posts and platform floor at the sheaves and is set upon concrete piers. According to the 1915 annual report it was erected at a cost of $5,873. Details of the cost of construction are:

LABOR		
Chief engineer	$147.00	
Draftsman	144.50	
Grading	60.00	
Concrete foundations	412.25	
Carpenter work, framing, etc	307.75	
Electrician	36.00	
Machinist	3.00	
Contractors (erecting)	676.41	
		$1,786.91
MATERIAL		
Sheaves	$384.43	
Lumber	60.31	
Freight	26.71	
Sundries	27.57	
Structural steel, fabricated	3,587.37	
		4,086.39
Total cost		$5,873.30

Production of Copper in Russia in 1915

According to the *Russian-American Journal of Commerce,* the production of copper in Russia in 1915 was 29,800 short tons, compared with 36,430 short tons in 1914. There was an increased production in the Urals, but a decrease in the Caucasian and Siberian works, the output of which was only 9,544 tons in 1915, as compared with 16,275 tons in 1914.

PERSONALS

H. C. Harbrecht has gone from Champaign, Ill., to Oatman, Ariz.

H. H. Harpham, recently in Mexico, has gone to Los Angeles.

Y. C. Kuang, recently in New York, is now at Hongkong, China.

H. F. Janson, recently at Houghton, Mich., has gone to Copper Cliff, Ontario.

J. M. Boutwell is in Peru, preparing a geological report on the Cerro de Pasco mines.

H. C. George has been appointed general manager of the Wisconsin Zinc Co., succeeding H. S. Snow.

Thirty-five Students in the Colorado School of Mines have gone to Texas in the Colorado State Militia.

H. T. Durant, a well known British metallurgist, is lieutenant in the 13th Battalion of the Hampshire Regiment.

William N. Norris, lately at Princeton, N. J., is now with the New York & Honduras Rosario Mining Co., San Juancito, Honduras.

H. Cecil, of New York, who is extensively interested in mining claims in the Gold Lake district of Manitoba is visiting the camp.

Ralph Arnold, consulting geologist and petroleum engineer, announces the removal of his New York office to the Equitable Building, 120 Broadway.

J. B. Tyrrell, of Toronto, Ont., is spending some time in British Columbia. His address while there will be Vancouver Hotel, Vancouver, B. C.

George E. Farish, 25 Broad St., New York, has moved his western office from Denver, Colo., to Nevada Bank Building, 14 Montgomery St., San Francisco, Calif.

L. M. Banks has gone from Chloride, Ariz., to Denver.

F. W. Traphagen, professor of metallurgy in the Colorado School of Mines, has resigned that position and is now president of the Colorado Metal Mining and Reduction Co.

N. O. Lawton has completed the exploration work he has been doing in Hancock County, Tenn., and has gone to South Strafford, Vt., to examine some copper properties there.

Dr. William B. Phillips has resigned his position as president of the Colorado School of Mines. It is understood that he will undertake the development of some mining property in Texas.

Extensive examinations are being made in Southwestern Oklahoma by the Associated Geological Engineers; the field parties being headed by Prof. **Clyde T. Griswold** with occasional visits by **F. G. Clapp.**

C. H. Poirier, of the Porcupine Vipond, Porcupine, Ont., and **M. W. Summerhayes,** of the Porcupine Crown, have been selected as engineers to value the McIntyre, McIntyre Extension and Jupiter properties to ascertain the basis for a merger.

Dr. Henry M. Howe, emeritus professor of metallurgy in Columbia University, has been appointed honorary vice-president of the Iron and Steel Institute of Great Britain. This distinction is held by only two other persons, Giorgio E. Falck, of Italy, and D. Tschernoff, of Russia.

George H. Crosby, Jr., son of George H. Crosby, of Duluth, has wedded Miss Elsa Bieberman, daughter of Louis Bieberman, also of that city; they will make their home in Crosby, Minn. Mr. Crosby has just graduated from the Sheffield Scientific School at Yale, and will follow his profession of mining in the Cuyuna range.

Harrison A. Dunn was reported in the "Journal" of June 17 as being imprisoned in the City of Mexico. In response to inquiry respecting him we interested Mr. Manning, director of the U. S. Bureau of Mines, and he reported that on July 4 the Department of State wired the American representative in the City of Mexico to renew representations in behalf of Mr. Dunn. On July 10 the State Department reported that it had heard from its representative that the prospects for the release of Mr. Dunn were good but that no definite action had been yet taken. Mr. Dunn's friends will be glad to know that his case is receiving energetic attention. Mr. Dunn is well known as a mining man, being a graduate of the Michigan College of Mines in 1909.

OBITUARY

Alvin R. Kenner was drowned at Olympia Park, near Grass Valley, Calif., on July 5. He graduated from the Colorado School of Mines in 1907. He had been superintendent for the Rio Plata Mining Co. of Mexico for several years and had recently left Mexico. He was in Grass Valley on business for the company.

The estate of **Barton F. Sewell,** formerly vice-president of the American Smelting and Refining Co., who died in January last, has been valued by the state appraiser at $1,441,881. The property is bequeathed to his wife and children, with a few legacies to friends. The greater part of the estate is in stocks and bonds of the Braden Copper Mines Co., of which he held 118,058 shares of stock and $615,351 in bonds.

SOCIETIES

University of Illinois—The Graduate School of the University has recently made an appropriation for a geological expedition to Hudson Bay during the summer of 1916. The work will be in charge of Prof. T. E. Savage and Dr. F. M. Van Tuyl, of the department of geology, who will be in that region from the latter part of June to the middle of September. It is planned to examine the outcrops and make detailed collections of fossils along most of the larger rivers south of the Churchill on the west side of the bay, in an effort to obtain more definite information concerning the Paleozoic succession and the ancient sea connections in that part of the continent. Evidences of recent elevation of the shore line, and other features will also be studied.

INDUSTRIAL NEWS

Lidgerwood Manufacturing Co. has moved to new quarters at 63-65 Columbia St., Seattle, Wash.

The Asbestos Protected Metal Co. of Pittsburgh announces that hereafter it will be represented in Cincinnati, Ohio, and surrounding territory, by E. G. Irwin, located in the Union Trust Building.

Jeffrey Manufacturing Co., of Columbus, Ohio, has opened a new branch office in the Commonwealth National Bank Building, Dallas, Tex., and also one in the Railway Exchange Building, St. Louis, Mo.

The E. H. Moyle Engineering and Equipment Co., Los Angeles, Calif., has moved its office to 508 East Ninth St., where it will show and demonstrate goods, and also make laboratory and metallurgical tests.

The Vulcan Soot Cleaner Co., of Du Bois, Penn., states that their New York representative, the De Ved-Kissick Co., has recently obtained what is claimed to be the largest order on record for the type of apparatus manufactured by that company. Soot cleaners are to be installed on 50 boilers of the B. & W. type, totaling 30,000 hp. rated capacity, at the Marion plant of the Public Service Electric Co., of New Jersey. The same company has recently equipped their 1,375-hp. boilers for the new Essex plant with Vulcan cleaners Other large orders have been received recently from the Cal umet & Hecla Mining Co.; Youngstown Sheet and Tube Co. North American Chemical Co. and others.

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., has received the following orders recently from the Chile Exploration Co.: For two 450-hp., self-starting, 3-phase, 50-cycle, 500-volt synchronous motors for compressor service, with shoe rails, dampers and starting auto transformers for 100% power factor operation, two 10-kw., 125-volt, 1,080 r.p.m. exciters and two starting panels, to be installed at Antofagasta, Chile; from the Utah Copper Co. and its allied interests, for 211 vertical agitator motors for separating copper from low-grade ore and tailings by the use of the flotation system; from the Tacoma Smelting Co., 10 complete equipments, consisting of motor-generators, transformers and switchboards for precipitating smelting fumes by the Cottrell process; from the Butte & Superior Copper Co., for a flywheel motor-generator, direct-current hoisting equipment. Similar equipments have also been sold to the United Verde Co., Jerome, Ariz., and the Hercules Mining Co.

TRADE CATALOGS

Herringbone Gears. Fawcus Machine Co., Pittsburgh, Penn. Catalog. Pp. 16. 9x12 in. Illustrated.

Surveying Instruments. Buff & Buff Mfg. Co., Jamaica Plain Station, Boston, Mass. Catalog. Pp. 124, 6x9 in.; illustrated.

Chute Gates for Ore, Coal, Ashes, etc. C. W. Hunt Co., West New Brighton, N. Y. Catalog No. 15-3. Pp. 28. 6x9 in. Illustrated.

Duplex Power Driven Air Compressors. Ingersoll-Rand Co., 11 Broadway, New York. Form 3312. Pp. 20. 6x9 in. Illustrated.

Telephone Apparatus and Supplies. Western Electric Co., 463 West St., New York. Catalog No. 3. Pp. 404. 6½x9½ in. Illustrated.

Duplex Direct-Connected Air Compressors. Electrically Driven. Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3026. Pp. 40. 6x9 in. Illustrated.

Trill Indicators. Trill Indicator Co., Corry, Penn. Catalog. Pp. 56. 6x9 in. This contains description and illustrations of the latest types of engine indicators and accessories made by this company, with information on taking and reading indicator cards. Twenty-two pages are devoted to instruction and general hints on the use of the indicator, including the drawing of the theoretical cards, determining the clearance of the indicator card, and to characteristic and faulty diagrams, pointing out the faults, and mode of correction. The indicating of compound engines and gas engines is also discussed in an interesting and illuminating way. This catalog should be most valuable to any engineer using an indicator.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

AMALGAMATOR. Percy A. Robbins, Timmins, Ont. (U. S. No. 1,190,012; July 4, 1916.)

CONVEYORS—Automatic Brake for Conveyors. William Brasack, Fairmont, W. Va., assignor to Fairmont Mining Machinery Co., Fairmont, W. Va. (U. S. No. 1,187,247; June 13, 1916.)

CRUSHING MACHINE. Axel G. J. Rapp, Chicago, Ill., assignor to Link-Belt Co., Chicago, Ill. (U. S. No. 1,187,549; June 20, 1916.)

EXCAVATING—Tooth for Dippers of Excavating Machines. Edward L. Pemberton, New Haven, Conn., assignor to American Manganese Steel Co., Augusta, Me. (U. S. No. 1,188,480; June 27, 1916.)

FLOTATION—Ore Concentrator. George B. Eberenz and James I. Brown. Cripple Creek, Colo. (U. S. No. 1,187,822; June 20, 1916.)

HEAT TREATMENT—Method of Heat Treatment. William J. Wrighton, Philadelphia, Penn., assignor to Leeds & Northrup Co., Philadelphia, Penn. (U. S. No. 1,188,128; June 20, 1916.)

LAMP—Miner's Acetylene-Gas Lamp. John Sutch, Oliver Sutch and Alexander Bell, Castlegate, Utah. (U. S. No. 1,189,014; July 27, 1916.)

MINE-CAR WHEEL. Carl Clausen, Bisbee, Ariz. (U. S. No. 1,190,111; July 4, 1916.)

PRECIOUS-METAL RECOVERY—Apparatus for the Recovery of Precious Metals from Metalliferous Earths. Peter N. Ramsey, New York, N. Y. (U. S. No. 1,187,927; June 20, 1916.)

REVERBERATORY IRON-MELTING FURNACES, Method of Operating. John Albert Swindell, Pittsburgh, Penn. (U. S. No. 1,188,111; June 20, 1916.)

ROASTING—Apparatus for Treating Ores. Charles W. Singer, Linden, Wis., assignor to Campbell Magnetic Separating Co., a corporation of Arizona. (U. S. Nos. 1,188,566 and 1,188,567; June 27, 1916.)

ROASTING—Stirring Device for Mechanical Roasting Furnaces. Jasef Claude. Frankfort-on-the-Main, Germany, assignor to Metallbank und Metallurgische Gesellschaft A. G., Frankfort-on-the-Main, Germany. (U. S. No. 1,187,504; June 20, 1916.)

SEPARATOR—Vacuum Ore Separator, Harry H. Baer, Orrville, Ohio. (U. S. No. 1,186,874; June 13, 1916.)

SMELTER FUMES—Recovering Noxious and Other Materials from Smelter Fumes. Clarence Barrett, Salt Lake City, Utah, assignor of one-half to George Morrow, Salt Lake City, Utah. (U. S. No. 1,188,237; June 20, 1916.)

SLAG LAUNDER LINING. William A. Leddell, Morenci, Ariz. (U. S. No. 1,189,842; July 4, 1916.)

TITANIFEROUS PRODUCTS and Method of Producing the Same. Louis E. Barton, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,189,229; July 4, 1916.)

NEW PUBLICATIONS

HANDBOOK AND DESCRIPTIVE CATALOG OF THE METEORITE COLLECTIONS IN THE UNITED STATES NATIONAL MUSEUM. By George P. Merrill. Pp. 205, illus. Bull. 94, U. S. National Museum, Washington.

THE FELDSPARS OF THE NEW ENGLAND AND NORTH APPALACHIAN STATES. By A. S. Watts. Pp. 181, illus. Bull. 92, U. S. Bureau of Mines, Washington.

COAL-MINE FATALITIES IN THE UNITED STATES, 1870-1914, with Statistics of Coal Production, Labor and Mining Methods, by States and Years. Compiled by Albert H. Fay. Pp. 370, illus. Bull. 115, U. S. Bureau of Mines, Washington.

THE ANALYSIS OF PERMISSIBLE EXPLOSIVES. By C. G. Storm. Pp. 88, illus. Bull. 96, U. S. Bureau of Mines, Washington.

STRENGTH AND OTHER PROPERTIES OF CONCRETES AS AFFECTED BY MATERIALS AND METHODS OF PREPARATION. By R. J. Wig, G. M. Williams and E. R. Gates. Pp. 172, illus. Technologic Paper No. 58, U. S. Bureau of Standards, Washington.

GEOLOGY AND UNDERGROUND WATER OF LUNA COUNTY, NEW MEXICO. By N. H. Darton. Pp. 188, illus. Bull. 618, U. S. Geological Survey, Washington.

MINERAL PRODUCTION OF CANADA DURING THE YEAR 1914. By John McLeish. Pp. 362. Canada Department of Mines, Mines Branch, Ottawa.

AN INVESTIGATION OF THE LAWS OF PLASTIC FLOW. By Eugene C. Bingham. Pp. 45, illus. No. 278, Scientific Papers of the U. S. Bureau of Standards, Washington.

TESTS OF REINFORCED CONCRETE FLAT SLAB STRUCTURES. By Arthur N. Talbot and Willis A. Slater. Pp. 128, illus. Bull. 84, Engineering Experiment Station, University of Illinois, Urbana, Ill.

MINERALOGIC NOTES, SERIES 3. By Waldemar T. Schaller. Pp. 164, illus. Bull. 610, U. S. Geological Survey, Washington.

Gives the results of the smaller, independent pieces of mineralogic research work carried out by the writer in the chemical laboratory of the United States Geological Survey, from July 1, 1911, to Dec. 31, 1913. Earlier reports of a similar nature have been published as Bulletins 262, 490 and 509 of the Survey, in 1904, 1911 and 1912.

A HANDBOOK OF COLLOID CHEMISTRY—The Recognition of Colloids, the Theory of Colloids, and Their General Physico-Chemical Properties. By Wolfgang Ostwald. Translated by Martin H. Fischer. 6x9½, pp 278, illus.; $3. P. Blakiston's Son & Co., Philadelphia, Penn.

This is a translation of the well-known German edition of 1911. The subject matter is that of "pure," or theoretical, colloid chemistry, including the nature of the colloid state and its definition, the relations of colloids to other states of matter, the energy relations of colloids and their mechanical properties such as viscosity, diffusion and the brownian movement. A second part, covering other specific chemical and physical properties of colloids, was originally planned but has never been issued, even in German. In the main the treatment is general rather than specific, and except for some references to biology, there is practically no discussion of the application of colloid chemistry to other sciences or to technology.

If this translation had appeared immediately following the German edition, it would have been very useful. It can scarcely be thought so now. Not only is five years a long time in a subject which is developing so rapidly as is colloid chemistry, but the lack of texts of colloid science in English has now been supplied by the excellent works of Taylor[1] and of Burton[2] and the briefer but no less excellent sketch of Hatschek.[3] Specialists are already familiar with the Ostwald work in the original. Beginners or incidental inquirers will do better to use the later works. Engineers in search of superficial acquaintance with the properties of colloids will find what they want in Hatschek as well as anywhere, and in briefer compass. The need, generally admitted, for a larger test of practical colloid chemistry useful to engineers and industrial chemists is not met by the Ostwald work or, for that matter, by any other which has yet appeared. The chief merit of the Ostwald book, and at this late date almost its only merit, is a clarity of style and an interesting manner of presentation which were noticeable in the original and which the translator has reproduced quite well. It is inexcusable, however, to use the barbarous term "dispersion means" instead of the well-established "dispersion (or dispersing) medium." E. E. FREE.

[1] "The Chemistry of Colloids and Some Technical Applications." By W. W. Taylor, 5x7, pp. 328; Longmans, Green & Co., New York, 1915.

[2] "The Physical Properties of Colloidal Solutions." By E. F. Burton. 5½x9, pp. 200; Longmans, Green & Co., New York, 1916.

[3] "An Introduction to the Physics and Chemistry of Colloids." Second Edition. By Emil Hatschek. 5x7½, pp. 107. P. Blakiston's Son & Co., Philadelphia, 1916.

Editorial Correspondence

SAN FRANCISCO—July 5

The Blue Ledge Copper Country in the northwestern part of Siskiyou County is receiving considerable attention this summer and several companies are continuing developments begun a number of years ago. Plans are being made for the extension of the Medford (Ore.)-Jacksonville Rd., 30 mi. south into the Blue Ledge mining district and eventually perhaps to Eureka in Humboldt County. The pass connecting the Rogue and Klamath Valleys will be used by the proposed Eureka-Medford railway. The National Forest is said to have five billion feet of mature timber that is now deteriorating along this route, and there are promising copper deposits in the Klamath and Applegate Valleys besides the Blue Ledge copper deposits. Much of Siskiyou and Trinity Counties' gold production, as well as mines in Jackson County, Ore., could be best served by this road. Humboldt County would also furnish its quota of traffic from deposits at present inaccessible.

Potash Production at Searles Lake is planned by the Pacific Coast Borax Co. This company owns the only patented land at this greatest American potash deposit, title to the Borax company's land having been granted years ago when the borate was supposed to be the only valuable mineral contained in the mud flats. The land taken up by the borax interests embraced a small portion of the "crystal area" of Searles Lake, and enables the company today to draw the potash-bearing brine from the interstices of the crystal body. Some time ago, the Borax company shipped two tank cars of Searles Lake brine to its Alameda works for testing a method of potash recovery worked out by its chemists and those of the Solvay Process Co. Results were successful and the company is now engaged in drilling wells for fresh water, surveying pipe line and other work preliminary to erection of a plant. A mill site has been filed upon about 1¼ mi. distant from the brine-pumping plant.

BUTTE—July 5

The Report About Anaconda going into Katanga copper deposits is all moonshine.

The Tuolumne Copper Co. is doing extensive preliminary work at the Butte Main Range and Colusa-Leonard Extension properties on the east side of the Butte district. General Manager Paul Gow says he will be shipping ore in 60 days. A fine body of ore was uncovered in the Sinbad shaft, a Main Range property, while the shaft was being enlarged and retimbered at a point about 70 ft. above the 600-ft. level. The same ore has been found in a drift westward from the shaft on the 500-ft. level and at about the end line of the Colusa-Leonard ground. The ore runs from 9 to 20% copper, and it is the intention of the management to mine this ore as soon as the shaft is retimbered, which is being done from the 700 to the surface. The shaft was in bad shape and too small for good work. It is likely that eventually both the Main Range and Colusa-Leonard will be operated through one shaft, although the Colusa-Leonard shaft will be opened shortly and some exploration work done from it. All the new surface buildings at the Sinbad shafts are being erected near the west end line, convenient to the Colusa-Leonard, and both properties will be placed within one fence. In the mining separate ore bins will be built and the ore from the two properties kept separate.

Statements of Butte Mining Companies, filed with the county assessor, in compliance with legal requirements, show income and expenditures for the purpose of assessment. Anaconda Copper Mining Co.'s statement for the year ended May 31, 1916, shows net proceeds of $14,363,881, which is $7,895,442 greater than for the preceding year. This takes in only the company's mines in Silver Bow County. The output during that period was 4,946,061 tons of ore, having a gross value of $11.996 per ton; cost of extraction was $4.14 and cost of reduction $2.04 per ton. The annual report of the North Butte showed: Tons of ore extracted 495,275, gross value $5,103,252; cost of mining, per ton, $4.18; cost of reduction, $2.44 per ton; net proceeds, $1,229,340. The report of Butte & Superior Mining Co., covering operations at its Black Rock mine, is as follows: Tons of ore extracted 591,562, having a total gross value of $20,271,949; cost per ton for extraction, $5.45; smelting, $7.15 per ton; total net earnings, $10,497,079. Elm Orlu shows for the year ended June 1, 200,772 tons of ore extracted; value, $18.52 per ton; cost per ton for extraction was $5.04; total cost of reduction and sale was $8.88 per ton. Net proceeds were $495,757. East Butte showed total production of 240,120 tons of ore with a gross value of $4,505,701; net proceeds were $1,070,060.

DENVER—July 7

Cripple Creek District Production in June amounted to 82,946 tons of ore averaging $14.26 per ton, making a gross output of $1,183,371. The Golden Cycle mill at Colorado City treated approximately 39,000 tons, or about 50% of all ores that were not shipped to smelteries.

Georgetown and Silver Plume, neighboring towns in western Clear Creek County, after more than a decade of quiescence, are becoming active. Substantial productions of silver, lead and zinc ores are being made, chiefly from old mines that were closed because of the low prices for silver and lead and the heavy penalties formerly imposed by smelters upon zinc contents. A recent strike in the Seven Thirty mine disclosed a fine shoot of 1,290-oz. silver ore. The Josephine, Raymond, Virginia City and McClelland are among the active mines.

A New Tungsten Custom Mill is now in operation in Gilpin County, the plant of the Rare Metals Ore Co. having just been completed at Rollinsville, a station on the Denver & Salt Lake R.R. This mill is only four miles from Nederland, though in a different county. The nominal daily capacity is now 75 tons, but it can be easily enlarged to meet any future requirements. Nelson Franklin, well-known sampler of the Cripple Creek district, is manager for the company, the ownership in which is practically identical with that of the Vindicator Consolidated Gold Mining Co.

Renewal of Tungsten Leases by the Primos Mining and Milling Co. has heartened the tungsten producers of Boulder County. The company has announced that it will continue to buy ore from its leasers on the present schedules. Several hundred men are working in the company's mines. The McKenzie mill, a short distance east of Nederland, formerly a gold mill, has been remodeled and is treating tungsten ores from the McKenzie mine as well as custom ores. To boost its county, the "Boulder County Miner," on June 29, issued a magazine supplement of 36 pages entitled "Tungsten Edition." This number is well printed, containing many illustrations of well-known men, mines and scenery in this county, together with numerous excellent articles of historical interest.

SALT LAKE CITY—July 7

The Utah Leasing Co., which is working the tailings dump of the Cactus mill at Newhouse, in Beaver County, will double the present capacity of the flotation plant, bringing it up to 800 tons daily. The mill is designed for 400 tons, but is now treating about 475 tons of tailings per day. The tailings are treated in two Hardinge pebble mills and two Dorr classifiers and then in flotation cells. Ten additional flotation cells are on the ground and will be installed at once. The ratio of concentration is about 35: 1, concentrates run about 21% copper. The old tailings are dug by steam shovel.

Much Ore Is Being Stockpiled at Utah mines, the Valley smelters having requested the mining companies to hold ore shipments at contract limits. Production for the first six months of 1916—stimulated by the high price of metals—has proceeded at such a rate, as to have for the time being exceeded smelter capacity. Besides this, the accumulation at properties inaccessible to ore-teams during the winter months, released with the opening of roads during May and June, caused considerable congestion at the railroads, sampling and smelting plants. Data regarding production by Utah mines, collected by the U. S. Geological Survey, indicate a much increased output of copper and lead for 1916. Silver, which is dependent upon lead will also show an increase. There will not be any important increase in gold; zinc from sulphide concentrates, and oxidized and sulphide ores will be about the same as in 1915, when the output was 22,000,000 lb. Lead from Bingham will exceed all former totals. Estimating the increased tonnage treated at the concentration mills near Garfield, copper production should amount to fully 225,000,000 lb. for the year.

Metallurgical Research at the University of Utah, carried on under the joint direction of the U. S. Bureau of Mines and of the University, is starting its new year—from July 1, 1916, to July 1, 1917—and the new holders of fellowships have

also begun their work. There are seven of these fellowships. Experimental work is being done with a view to developing methods of treatment for the recovery on a commercial basis of the metals in low-grade and complex ores. In Tintic there is a large tonnage of low-grade silver-lead ores, copper-gold-silver ores, and zinc ores, all of which are oxidized. Park City has much lead-silver and lead-zinc ore that is partially oxidized, and in Bingham there are complex sulphides of lead, zinc and iron. Samples of the various types of ores have been collected, and are being worked on. The laboratories are well equipped with leaching, flotation and water-concentrating machinery. There is also a hydro-electric laboratory and a microscopic laboratory. The flotation laboratory has installed Callow, Janney, Case and other well-known flotation machines, and experiments on different ores with all kinds of oil are being made. A flotation process has been developed to treat lead-carbonate ores carrying silver; and the Prince Consolidated Mining Co. of Pioche, Nev., is building a plant to use this process. Leaching with saturated salt solution, to which sulphuric acid is added, has been developed for lead-silver ores which will not yield to flotation. Good work is being done in the problem of the separation of the lead from the zinc-lead sulphide ores. The zinc is leached out by the Anaconda process or the lead is leached out by the acid-brine process. In this way the lead in the zinc ores, hitherto a loss to shippers, is recovered. The research work of the bureau is under the direction of D. A. Lyon.

PHOENIX, ARIZ.—July 5

Higher Freight Rates will be charged on copper bullion, matte and ore going to New York and Eastern refineries. The El Paso & Southwestern Railroad Co. has filed a new tariff with the Arizona corporation commission advancing the rates on shipments from Douglas, Morenci and Clifton 15 to 30%. The commission has communicated with the companies affected, asking if they wish the Interstate Commerce Commission requested to suspend the new rates.

Developments at Tombstone above water level in the old Tombstone Consolidated have disclosed some interesting ore-bodies. The Bunker Hill Mines Co., a Phelps-Dodge corporation, took over these old properties a year or so ago and began development in the upper levels, under the direction of Emil Grebe, avoiding the task of pumping the enormous flow of water that wrecked the old company. Above the water level, the Bunker Hill company is blocking out gold-silver-lead ore, and in the Tranquility-Tough Nut-Contention section has uncovered numerous bodies of wulfenite. For treatment of low-grade gold-silver ores, 30 stamps with cyanide adjunct have been equipped for percolation of sands and agitation of slimes. In the Escondido, Lucky Cuss, Oregon and Prompter mines, manganese ores have been opened; high-grade ore has been shipped as chemical ore; some of the lower grade as "furnace" ore and some concentrated; the concentrates are graded as chemical ore and the tailings, containing about 10 oz. Ag, are shipped as flux to the Copper Queen smeltery.

Assessment of Producing Arizona Mines, for purposes of taxation, has been placed this year at $172,731,913, an increase of $54,705,910 over last year's figures. While the price of copper and the increase of production have been considered in estimation of the worth of the mines, the Inspiration property at Miami this year is assessed $20,400,896, compared with about $2,000,000 last year. The Copper Queen has been raised about $9,000,000 and the other great mines a few millions each. The assessments on the principal properties follow: Copper Queen, $36,159,300; Calumet & Arizona, $25,248,003, including its Ajo property; United Verde, $20,687,010; Inspiration, $20,400,896; Ray, $15,568,782; Miami, $11,406,803; Arizona Copper, $10,362,468; United Verde Extension, $5,360,280; Shattuck-Arizona, $5,229,400; Old Dominion, $4,487,152; Detroit, $4,394,774; United Globe, $4,353,936; Tom Reed, gold, $2,053,270; Shannon, $1,020,797. Of the smaller operations, the Magma is assessed $743,466, Arizona Commercial $555,838, American Smelting and Refining Co.'s leases, $668,909 and the Consolidated Arizona, $251,535. These figures are exclusive of smelting and reduction plants, or of non-producing mine valuations, which are expected to bring the gross total up to about $212,000,000. These figures are interesting by comparison with those of 10 years ago. The entire tax roll of Arizona was then $62,000,000; of this, the mining industry was taxed $14,574,049 on all classes of property.

JOPLIN—July 8

Joseph Myers, fomer chief of police in Joplin, has been appointed by Governor Major to succeed I. L. Burch, who resigned as deputy state mine inspector for this district several weeks ago.

Another Cut in Wages took place this month and had the effect of sending many of the shovelers to the harvest fields rather than submit to a cut in the wage scale. Many of the plants have been short-handed for shovelers for a long time anyway and the new wage scale will still further reduce the number of men working and the output. Coming at a time when the surplus stocks of ore in the bins is in the neighborhood of 25,000 tons, every movement toward reduction in output will be a safety factor toward the prevention of further recession in ore prices. There have been many natural obstacles to ore production this spring and summer in the way of floods and much ground water. Had the season been more propitious, the surplus stocks of ore in the bins would be much greater.

The Higher Powder Cost will affect many Joplin operators, especially in the hard sheet-ground camps, who have been buying their dynamite upon contracts made before the rise in the price. Powder that was $4.50 per box under these contracts is costing in the market nearly three times that price now. In those mines in which the powder cost is already high, this additional burden is keenly felt. This applies especially to the low-grade mines. The last week saw a number of these compelled to close down or sell their plants to men who have advantageous contracts yet in force. There are a good many subterfuges being attempted to get powder at the old figures. There has been a small reduction in the price of caps due to the lowered price of mercury but this item is small as compared with the amount of dynamite used. This situation means a further reduction in the output of the sheet-ground camps.

VIRGINIA, MINN.—July 8

Shipments of Ore are being maintained, the pit mines working to capacity. Loading is still going on from the stockpiles and there will be no shortage. Although most of the Mesabi mines were closed during the greater part of June, the iron-ore shipments from the Lake Superior district broke all previous records for a single month by over 1,000,000 tons. The June movement amounted to 9,500,000 tons, against 8,400,000 tons in May, the previous record. It looks very much at this time as though the total for the year would reach 55,000,000 tons; it will go over 52,000,000 tons if shipments for the remainder of the year are equal to last year.

The I. W. W. Labor Disturbance on the Mesabi range seems to have passed its zenith. Combined efforts of state and county officials, business men and mine operators have restored order. Practically all strike leaders are now arrested and held on various charges from minor misdeeds to murder. It is estimated that in the Hibbing district alone nearly 1,000 good miners left the district rather than become embroiled in a strike. At 3 a.m., July 8, the residence of Tom Kobiach, Franklin Location, Virginia, was partially destroyed by dynamite. Kobiach has continued to work daily at the Franklin mine despite threats of the strikers. At Biwabik, on July 3, a deputy sheriff and a bystander were killed when an effort was made to serve warrants. Several other deputies were injured. Conditions generally, however, are much improved.

TORONTO—July 10

The Canadian Nickel-Refining Plant of the International company is not likely to be commenced this year. It is understood that nothing will be done before the report of the Ontario Nickel Commission is presented, and this is not expected until late in the fall. The plant, according to announcement, is to be on a scale sufficient to supply the demands of the British Empire, and the report is expected to set forth the nature and extent of these requirements. Were the company to proceed with operations in the meantime, it might find it necessary to extend or modify considerably its original plans. Meanwhile, the delay is being used to reinforce the arguments of the scare-mongers.

The Nickel Question is coming to the front as a political issue. A keen by-election contest for the representation of North Perth in the Ontario legislature is being waged, and the nickel policy of the Provincial Government is strongly attacked by some of the extreme advocates of nickel refining in Canada. A letter from W. F. Maclean, M. P., of Toronto, the leader of the agitation, who delivered metallurgical lectures to the Parliament last winter explaining how to get 50 lb. of nickel alloy from 100 lb. of 2% nickel ore, now asserts that the International Nickel Co. is under German control, and that Canadian nickel is being supplied to the Germans, and the Canadian and Ontario administrations are charged with pursuing an unpatriotic policy under the influence of agents of the International. This attack is practically, though not formally, endorsed by the Liberal party from political motives, and may have an important influence in deciding the election. The arrival of the German merchant submarine in the States and the rumor that nickel will be a part of its return cargo, will doubtless be used by these politicians with telling effect.

The Mining News

ALASKA

JAFET LINDEBERG, of San Francisco, recently sailed from Seattle for Cape York tin district, taking an engine and small mill which will be tried out there during the summer.

ALASKA-GASTINEAU (Juneau)—Milled in June, 164,800 tons, averaging $1.06; in May, 175,215 tons of $1.40 ore; April, 165,930 tons, $0.94; March, 162,796 tons, $1.03; February, 122,856 tons, $1.02; January, 119,914 tons, $1.42. On July 3, milled 8,700 tons; second largest daily mill run thus far.

ARIZONA

Cochise County

COBRIZA (Johnson)—Shipping 3 carloads of copper ore daily to El Paso.

ETZ & WEBB (Johnson)—Have set up 20-ton custom mill near Little Dragoon Mountains; expect to add concentrating section soon.

Coconino County

ARIZONA NAVAJO COPPER (Flagstaff)—Engineers examining route from Flagstaff to the White Mesa mines, 110 mi. northeast. If White Mesa property proves to be big porphyry deposit, railroad will be built.

Greenlee County

ASH PEAK (Duncan)—Considering installation of flotation; electric plant, compressor and other heavy machinery being put in; Shamrock shaft now down 500 ft., will be sunk further; bottom in ore that runs $12 in silver; 1,000 tons of gold-silver ore on dump.

SHANNON COPPER (Clifton)—Profits for first five months of year $320,000; there was $560,000 working capital on June 1 after $190,000 had been set aside to take care of Shannon-Arizona Ry. bonds. Production for May 1,074,000 lb., which yielded a profit of about $100,000.

ARIZONA COPPER (Clifton)—Installation of 85 Callow flotation cells at Morenci mill about completed; will increase capacity to about 4,500 tons daily; main-hoist power being changed from steam to electricity; recently installed Ingersoll-Rand 5,600-cu.ft. compressor in operation; old concentrator at Clifton being remodeled to treat ores from Longfellow North Extension and King mines; will have daily capacity of 500 tons.

Maricopa County

SAMPLING AND ORE-PURCHASING WORKS, at or near Phœnix, proposed by W. B. Twitchell and others.

OVERLAND MINES (Wickenburg)—Shipping carload high-grade manganese ore weekly to Lewellyn Iron Works, Torrance, Calif.; mine 30 mi. southwest of Wickenburg.

Mohave County

PARAMOUNT (Oatman)—Has started sinking shaft.

UNITED WESTERN (Oatman)—Drifting north on 500-ft. level.

OATMAN BELLE (Oatman)—Compressor and hoist installed, and sinking again in progress.

TOM REED (Oatman)—New headframe finished for shaft near Big Jim property; sinking started.

OATMAN (PIONEER (Oatman) — Crosscutting on vein opened at 400 level; winze also to be sunk to 600 ft.

LEXINGTON (Oatman)—Development resumed. Eastern men having financed operation through stock underwriting.

TIPPERARY MINING CO. (Oatman)—New surface equipment being erected. Honolulu men have taken interest. J. R. Hemphill, secretary.

BLACK RANGE (Oatman)—Drifting on 300-ft. level in low-grade ore. E. McNeal & Co., of Chicago, have taken large block of stock, providing funds for continued development.

OATMAN GOLCONDA (Oatman)—New compressor and engine being installed on No. 1 shaft and unwatering started with new pumping plant. Sinking new shaft on vein near Apex Pioneer.

OATMAN GOLD (Oatman)—E. McNeal & Co., brokers, Chicago, have financed company for further exploration of 500-ft. level and necessary equipment. Charles T. Arkins appointed superintendent, vice E. Hilty, resigned.

Pima County

ROSSI AND MURPHY (Twin Buttes)—These properties, adjoining Bush & Baxter mine of American Smelting and Refining Co., have been optioned by F. B. Weeks, of Tucson, for U. S. Smelting, Refining and Mining Co.

Pinal County

MAGMA (Superior)—New 100-ton zinc concentrator making good progress; will be in operation soon.

CHILDS (Winkelman)—Molybdenum prospect, on Copper Creek, recently taken over by Col. Epes Randolph.

FINNEY COPPER (Christmas)—Churn drilling will be started soon. Drift on 100-ft. level in 3% ore carrying gold and silver.

PINAL DEVELOPMENT (Troy)—Has optioned Barbarosa group of 16 claims; hoist and 600-cu.ft. compressor ordered. John C. Devine, manager.

TROY ARIZONA COPPER (Troy)—Force on old Troy mine soon to be increased; Rattler shaft down 160 ft., and crosscut being driven southward to cut main orebody; Buckeye shaft down 500 ft., from which point crosscut will be run to cut Climax fault, 1,000 ft. distant; Alice shaft down 400 ft., passed through 4% copper sulphide. John Galvin and H. C. Rogers of New York, and Charles H. Barney, of Boston, interested; Roy G. Mead, superintendent.

Yavapai County

ARIZONA & CALIFORNIA MINING CO. (Prescott)—Encountered high-grade gold-silver ore in vein cut in Shamrock claim of New State group, 8 mi. south, while crosscutting to tap vein in 130-ft. shaft. Shipments to begin when air connection has been made. W. S. Wilhelm, president.

UNITED VERDE EXTENSION (Jerome)—Letter to stockholders states that orebody on 1,400-ft. level has been developed by about 2,000 ft. of lateral workings in ore, two raises 100 ft. above 1,400-ft. level and several raises in ore; winze being sunk at about center of orebody on 1,400-ft. level to at least 200 ft. Careful sampling on 1,400-ft. level shows 16% copper, and up to present have blocked out upwards of 600,000 tons of ore. It is proposed to sink new two-compartment shaft to be used exclusively for hoisting ore. After completion of winze and new shaft, it is intended to sink Edith shaft to greater depth.

Yuma County

A. L. KREISS, representing Los Angeles men, has been examining conditions at Parker with a view of erecting a 200-ton smelting plant if tonnage is assured.

ZEROLITE-MAMMON (Parker)—Tractor purchased to haul ore to Parker; initial shipment made to Garfield, Utah.

YUMA CONSOLIDATED (Quartzite)—Gravel in shaft from 80- to 95-ft. point, bedrock, averaged $5.24 per cu.yd. Second shaft being started, 200 ft. away.

BILLY MACK (Parker)—Chicago and Kansas City men made final payment on control stock of H. S. Griswold, of Phoenix, and H. Tharpe, of Parker; property 6 mi. north of Parker.

CALIFORNIA

Inyo County

JUMBO (Darwin)—This claim, optioned by Darwin Development Co., developing favorably; several carloads of high-grade silver-lead ore have been mined.

WILSHIRE BISHOP CREEK CO. (Bishop)—At meeting on July 1 all acts of directors were approved; audit by Audit Co. of Los Angeles complete but not ready for presentation; stated to be "favorable to management." "Contribution plan" of Feb. 28 circular brought in $30,473; outstanding, $41,860. Report of engineer, E. W. Walter, dated Oct. 1, 1915, recommended increasing 50-ton mill to 100 tons; ore reserves not specifically stated. Title to mine now appears to be in name of Rocky Point Consolidated Mines Co., Gaylord Wilshire, president.

Kern County

FURTHER GOLD STRIKES reported from Randsburg following the finds of Mapes and Weaver about midway between the old camps of Goler and Garlock.

Nevada County

MURCHIE (Nevada City)—This mine, bonded to H. W. Miller, of 654 W. 51st St., New York, is to be reopened. About 75 men formerly employed.

ALASKA (Nevada City)—Reported long drainage tunnel will be driven to develop mine at depth and avoid the $2,000 monthly pumping expense, which caused property to be closed.

Plumas County

ENGELS COPPER (Keddie)—Driving 4,000-ft. adit to cut orebodies 750 ft. below present workings. Flotation recovery reported to be 83%; mill capacity increased.

Shasta County

MAMMOTH COPPER MINING CO. (Kennett)—This company will erect electrolytic zinc plant to treat its zinc ores, and zinkiferous baghouse dust from its copper-smelting plant. High-grade zinc ore formerly went to Kansas smelteries.

Sierra County

CUBA (Downieville)—This gravel mine at Shady Flat on the Yuba has been bonded by John T. Mason to Thomas Wilson, who is installing pumping and hoisting plant.

GOLD BLUFF (Downieville)—Aërial tramway being extended from the Meservey to the Oxford tunnel. Ore will then be mined from both tunnels and sent to the 20-stamp mill. Controlled by Cliff Leasing Co., of Salt Lake City; Grant Snyder, manager.

Siskiyou County

BLUE WEDGE (Copper)—This copper deposit being developed by New York syndicate.

ST. ALBANS MINING AND MILLING CO. (Medford, Ore.)—Recently incorporated to work 22 copper-gold-silver claims near Copper; vein 20 to 50 ft. wide in places. Erecting camp buildings. Henry Callaghan, manager.

Trinity County

TRINITY DEVELOPMENT CO. (Carrville)—Construction of hull under way and much of machinery for new steel dredge on ground.

COLORADO

Clear Creek County

BELLMAN (Idaho Springs)—Hutchinson lease has opened 6-ft. vein of $9 milling ore. Bert Ziler, superintendent.

McCLELLAND TUNNEL (Idaho Springs)—Development proceeding; recently cut old Freeland vein. W. L. Shaffer, manager.

COMSTOCK (Idaho Springs)—Shaft sunk to 500 ft. Large vein of low-grade ore opened, containing stringers of molybdenite. Richard Staley, lessee.

LAKE (Idaho Springs)—Moore & Bell, who recently acquired Mosher lease, have developed payable ore and will ship 25 tons per day. H. N. Jones, superintendent.

NEW LIFE TUNNEL AND MINING CO. (Idaho Springs)—Recently incorporated to take over the Hoosac tunnel property and other mines. Incorporators are E. D. Quigley, H. C. Perks and F. A. Armour.

Lake County

FRYER HILL PROPERTIES nearly drained. Water in Harvard shaft 15 ft. from bottom and preparations for shaft sinking completed.

REVEILLE (Leadville)—Lessees on this California Gulch property making regular shipments. Work being done through upper tunnel, but lower tunnel will be opened.

WOLFTONE (Leadville)—Water being lowered to 980-ft. level. Heavy flow encountered between fourth and fifth levels where several large stopes must be drained.

La Plata County

COPPER HILL (La Plata)—Flotation process will be installed.

Pueblo County

COLORADO FUEL & IRON CO. (Pueblo)—New by-product coking plant will be installed in Minnequa steel plant. In addition to coke, gas, tar and ammonia liquor will be saved. Gas and tar will be used in steel plant; ammonia manufactured into fertilizer.

Ouray County

SUTTON (Ouray)—Mine being examined for purchase.

CAMP BIRD (Ouray)—Mill going out of commission, pending completion of the 10,700-ft. development tunnel.

San Miguel County

TOMBOY (Telluride)—Mill crushed in June 13,000 tons, yielding bullion $39,900, concentrates $55,000; expenses $66,250; operating profit $28,650.

Summit County

WATERLOO (Montezuma)—Will be reopened.

OLD UNION (Breckenridge)—Crosscutting commenced from 75-ft. level to open vein disclosed by dredging operations.

WELLINGTON (Breckenridge)—Second roaster for concentrates will be installed. Water in Sallie Barber shaft being lowered by bailing.

TONOPAH PLACERS CO. (Breckenridge)—Sure Thing shaft unwatered and driving to cut zinc-lead oreshoot discovered by dredge. Three dredges now in operation, one in French Gulch, one on Swan River and one on Blue River.

Teller County

ELKTON (Elkton)—Leasers working dump at main shaft are shipping about 15 carloads, monthly, running about $6 to $8 per ton.

ISABELLA (Victor)—Shipped about 2,000 tons in June. Buena Vista stope, fifth level yielding high-grade ore; two cars recently brought $3,600.

PRINCE ALBERT (Cripple Creek)—After long idleness, shipments again going forward—from the Vetter lease of this Beacon Hill property.

CONNECTICUT

TUNGSTEN CO. OF AMERICA (Long Hill)—This old tungsten property, about 8 mi. north of Bridgeport, is to be equipped with a 100-ton mill to operate on the blanket deposit reported to average 2 to 3% WO_3; higher grade ore found in pegmatite dikes. New York offices, 115 Broadway; Kirby Thomas, 120 Broadway, consulting engineer.

IDAHO

Lemhi County

LATEST OUT (Gilmore)—Leased Cook and Roy Lauer claims above 600 level from Gilmore Mining Co. and will open from Latest Out workings. Ralph Nichols, manager.

PITTSBURGH-IDAHO CO. (Gilmore)—Mining about 1,200 tons monthly of neutral 30% lead-carbonate ore, containing ½ oz. silver per unit of lead. Has also encountered high-grade gold ore as did other mines of camp—Allie and Gilmore. Sinking winze from 600 level. Plan to sink new vertical shaft from 400-ft. or transportation-tunnel level to 800-ft. level. Over 90 men working. A. S. Ross, manager.

GILMORE MINING CO. (Gilmore)—Raising from 800-ft. or transportation-tunnel level to connect with Latest Out's 600 level, establishing better ventilation and outlet for latter's ores. Raise up 60 ft.; at 30 ft., drift opened 3-ft. lead carbonate ore, carrying silver; two cars shipped ran 20% Pb, 22 oz. Ag and $1.40 Au. Gold vein opened at 400 ft. in Martha shaft; drifted on for 1,000 ft. to the north on 300-ft. level. About 20 men working. Edgar C. Ross, manager.

Shoshone County

CHICAGO-BOSTON MINING CO. (Wallace)—After tests in Western Union mill, company has decided to erect 200-ton flotation mill for its properties in Lake Creek district.

GREAT WESTERN MINING CO. (Wallace)—Being reorganized. W. P. Heimbach and other Duluth, Minn., men, on directorate with George Edimster, of Wallace. New development campaign planned.

FEDERAL (Wallace)—Output at Morning mine being increased; milling facilities already enlarged to handle augmented production. All mines produced in first quarter, this year, 31,844 tons shipping ore and concentrates; gross earnings, $356,125; net, $290,890.

GEORGIA

REPUBLIC MINING CO. (Andersonville)—This bauxite mine shipping 45 tons daily. J. H. Harris, manager.

NEW JERSEY ZINC CO. (Cartersville)—This company, which recently purchased American Ochre Co. property, has bought the Norris barite land, 40 acres, adjoining; also contains ocher. Both properties will be operated under superintendency of L. B. Wommelsdorf.

MICHIGAN

Copper

ISLE ROYALE (Houghton)—Rock production now close to 80,000 tons monthly.

CASS COPPER (Ontonagon)—Second diamond drill hole now being started; first hole down 450 ft.

VICTORIA (Victoria)—Increased production from this property delayed by exigencies of new hoist installation.

ADVENTURE (Greenland)—Two weeks will be required for unwatering and it will probably be a month before hoisting of ore can begin.

AHMEEK (Ahmeek)—Seventh stamphead now in commission; eighth head will not be ready for about six weeks as additional boiler is awaited; a 2,500-kw. turbine for mine use is also to be installed.

MINNESOTA

Cuyuna Range

ROWLEY (Barrows)—Shaft down 60 ft.; 300 gal. of water per minute encountered.

ADBAR (Brainerd)—Raising 1,600 gal. of water per minute. Shaft down 75 ft.; 25 ft. still to go.

FLYNN (Manganese)—E. J. W. Donahue and Duluth associates have started sinking a 6x8-ft. shaft. Two drills at work.

JOAN MINING CO. (Duluth)—Incorporated to hold leases in Sec. 3, 49-27. Properties partially drilled; contain manganiferous iron ore of good grade. Capt. M. L. Fay, Duluth, secretary- treasurer.

CUYUNA-SULTANA (Ironton)—Thus far nearly 30,000 of season's estimated 80,000 tons have been shipped. Underground connection between No. 1 and No. 2 shafts nearly completed. New office, dryhouse and manager's residence recently erected.

Mesabi Range

OLIVER IRON MINING CO. SHIPMENTS from Lake Superior districts for the season to July 8 aggregated 11,000,000 tons, as against 8,000,000 on same date in 1915.

AGNEW (Hibbing)—One miner killed and another seriously injured by cave-in June 8.

MISSOURI

Southeast Missouri

BENEDICT J. BAKER, of Boston, president of the Baker and the Boston-Elvins companies, is drilling large acreage northwest of Bonne Terre.

BAKER LEAD CO. (19 Congress St., Boston, Mass.)—Doing much surface drilling in connection with development of Day tract at Leadwood.

BOSTON-ELVINS LEAD CO. (Elvins)—Shaft down 450 ft. on tract drilled by this Boston company. Making preparations to hoist 1,000 tons per day.

MINE LA MOTTE (Mine La Motte)—This property, comprising 37,600 acres in Madison County, is reported sold to the Valley Material and Transportation Co. of St. Louis, a new corporation in which A. J. Meier, of the old Mine La Motte company, is interested. Crushed limestone is expected to be an important product of the new company.

Joplin District

DR. CARL CO. (Galena, Kan.)—Will erect mill on lease Shoman & Stice land. Five drill holes put down all showed ore; will continue drilling.

ONCE MORE (Joplin)—Underground siphon being used to bring water from field shaft to mill pond. Water raised about 20 ft.

BLATCHLEY (Joplin)—Planning installation of steam shovel at tailing mill on Sweetwater lease; scraper method inadequate.

COMMERCE (Commerce, Okla.)—Will erect new mill on Goodwin & Cooper land, north of Picher, just south of Kansas-Oklahoma state line. Drilling shows ore at 225 ft. New shaft down 40 ft.

UTAH-MISSOURI (Neck City)—Building 1,000-ton mill on recently drilled tract. Ore from 187 to 222 ft.; semi-hard ground; about 4% recovery. H. R. Trenholm, manager. Mine to be known as the Goldfield. Company also operating Lucky Tiger and Cocklebur at Neck City. New shaft being sunk on Big Four lease will be connected by 1,000-ft. tram with Lucky Tiger mill.

Northern Arkansas

IN JUNE 59 CARLOADS of blende and zinc-carbonate ore were shipped from this field and at least 30 carloads were produced and are being held in bins for better prices. Of the cars shipped, 36 were from the Rush camp, four from Dodd City, four from Cow Creek, four from Water Creek, four from Kingdom Springs, five from Zinc, twelve from Searcy County, and one from Baxter County. It is expected that nearly 100 cars will be produced during July, as several new mills are starting or will be in operation before end of month. The Edith, the Silver Run and the Moark mills were recently started, the Dixie Girl, the White Eagle, the Sure Pop No. 2, the Washington, the Chickasa and the Omeara will have new plants in operation by August.

MONTANA

Madison County

MOFFIT (Twin Bridges)—Shipments suspended from this property in Bear Gulch. Has shipped two cars weekly since April.

Mineral County

TARBOX (Saltese)—Shaft is down nearly to 700 level. Will be carried to 1,000 level. Fine orebody opened on 400 level. Crosscuts will be driven on 500, 600 and 700 levels to intercept same orebody. Nearly 10,000 tons of ore on dump assaying 30% lead, 9 oz. silver and 9% zinc. Plans for mill being completed.

Silver Bow County

EAST BUTTE (Butte)—June production estimated at 1,500,000 lb.; first half of 1916, about 6,661,000 lb., or at a rate of 13,000,000 lb. per annum.

ANACONDA (Butte)—At Emma mine, everything is in readiness for sinking shaft from 800 to 1,600 level. New engine in place and other equipment ready for this work, as well as for stoping the zinc ore as soon as the reduction plants are ready. Crosscutting on the 1,600 level of Gagnon mine is being rushed; about 300 ft. more is to be done before point under Emma shaft will be reached and raising can begin.

BUTTE & SUPERIOR (Butte)—First Butte company to file report of net proceeds with county assessor for purpose of taxation. Report shows that for fiscal year June, 1915, to June, 1916, net proceeds were $10,497,079, as against $2,648,450 the year before. Report also shows that 591,562 tons of ore were mined of gross value of $20,271,949, an average of $34.269 per ton. Cost of extracting was $5.488 per ton; transportation, $2.15; ore dressing, $0.7149 per ton. Total disbursements were $4,229,117, as follows: Labor, $2,217,755; supplies $1,028,521; construction work, $605,824; improvements at Black Rock mine, $414,034. Program of improvements involves expenditure of $1,000,000, principal feature being sinking of the two new shafts.

NEVADA

Esmeralda County

REORGANIZED BLUE BULL (Goldfield)—Drifts on 700-ft. level continue to follow large quartz bodies yielding occasional encouraging assays.

GOLDFIELD CONSOLIDATED (Goldfield)—June estimated production, 29,000 tons; extraction, $185,000; operating expenses, $145,000; net realization, $40,000. May final results, net realization, $50,693 from 32,400 tons; net cost, $4.66 per ton.

Humboldt County

ROCHESTER MINES CO. (Rochester)—Pres. A. L. Friedman states present milling plant will be enlarged to capacity of about 200 tons per day. Excavation under way.

PACKARD NORTH EXTENSION (Lovelock)—Leasers recently shipped 70 tons $30 ore. Tunnel B, projected to cut extension of Packard vein, has about 40 ft. to go.

ROCHESTER CONSOLIDATED MINES CO. (Rochester)—Incorporated to develop group of six claims near Weaver claims of Rochester Mines Co.; Joseph C. Colligan, Pres.

ROCHESTER LIMERICK (Rochester)—Company organized to develop ground north of Rochester Merger; C. N. Miller, president. Main tunnel, now in 550 ft., to be driven additional 350 ft. to encounter vein on Lucky Joe claim.

Lincoln County

CONSOLIDATED MINING AND SMELTING CO. (Pioche)—New company to operate property in Freiburg district. Some equipment being hauled and pipe line laid.

Lyon County

COMO CONSOLIDATED MINES CO. (Dayton)—Organized by H. C. Cutler and associates to take over the Nevada Deep Mines Co., Peer and Lucky Sunday group. Equipped with modern stamp mill and 100-ton cyanide plant. Deeper development will be undertaken.

Nye County

TONOPAH ORE PRODUCTION for week ended July 1 was 9,043 tons valued at $189,934 compared with 9,075 tons for week previous. Producers were: Tonopah Belmont, 2,997 tons; Tonopah Extension, 2,200; Tonopah Mining, 1,800; Jim Butler, 800; West End, 643; Halifax, 210; Rescue-Eula, 178; miscellaneous, 215 tons.

WEST TONOPAH (Tonopah)—Sinking resumed; stated that shaft passed out of capping into trachyte at about 850 ft.

REORGANIZED WHITE CAPS (Manhattan)—Crosscut from bottom or 310-ft. level encountered vein; width and value not yet announced.

TONOPAH EXTENSION (Tonopah)—May profit $56,818, from treatment of 8,055 dry tons having net value of $130,743. Expect to complete repairs to Victor shaft by August.

TONOPAH DIVIDE MINING CO. (Tonopah)—Property at Gold Mountain, six miles south of Tonopah. Grimes & Hanson lease recently shipped to West End mill 60 tons returning $64 per ton.

White Pine County

NE PLUS ULTRA (Hamilton)—Producing about 100 tons monthly of high-grade ore. Considerable ore sacked, awaiting shipment via Eureka to Salt Lake smelteries. Working 11 men.

NEW MEXICO

Grant County

DAVID GOUGH, of El Paso, is developing a disseminated copper-sulphide deposit in the Steeplerock district.

MANHATTAN (Santa Rita)—Phillips & Morgan shipping to Douglas.

LAST CHANCE (Lordsburg)—Robert F. Fritz has reopened this mine.

VOLCANO (Steins)—Taken over by Faris V. Bush and associates, who may erect cyanide plant.

CHINO (Hurley)—In five months ended May 31 produced 27,289,792 lb. copper. Flotation being installed.

WALTER INTERRIEDEN AND C. TREADWAY (Lordsburg)—Have purchased Harris & Spence lease on the Nevada claim of "85" mine.

PROGRESS MINING CO. (Steeplerock)—New organization, composed of James V. Parks, Charles Hanson and L. A. Hohstadt, to develop claims lying northwest of the Carlisle, on the same vein.

85 MINING CO. (Lordsburg)—Order duplicating present Deisel power plant sent to Lyons-Atlas Co., Indianapolis; will bring plant up to about 900 hp.; 500-ft. point reached in sinking and crosscuts will soon be underway. Flotation plant under consideration. A. J. Inderrieden manager.

UTAH

Beaver County

MAJESTIC MINES CO. (Milford)—Elephant shaft on Hoosier Boy claim will be sunk from 600 to the 1,000 level. Old Hickory shaft will also be deepened. A. D. Moffat, manager.

Box Elder County

LAKEVIEW (Promontory Point)—Shipped in June 15 cars, four of lead ore and 11 of zinc. Winze from new lower level still in good lead-zinc ore. S. S. Arentz, manager.

Millard County

KING SILVER-COPPER MINING CO. (Delta)—Incorporated to operate silver-copper and silver-lead claims near Whiskey Creek Spring, 20 mi. east of Delta; B. F. Johnson, manager.

BEAVER RANGE MINES CO. (Blackrock)—New company to acquire 10 claims in Mineral Mountain Range, 10 mi. southeast. Both copper and lead veins opened by 1,500 ft. of adits and shafts. John B. Taylor, of Salt Lake City, president; William W. Moody, superintendent.

Salt Lake County

SOUTH HECLA (Alta)—Shipping 50 tons daily from the Wedge workings, 250 and 350 levels.

MICHIGAN-UTAH (Alta)—Copper Prince tunnel now in 1,400 ft., having been driven 240 ft. in June by two shifts. Narrow vein of good grade followed for about 50 ft.

EMMA (Alta)—This old mine, held by Jesse Knight for a number of years, has just been optioned to Charles W. Belser, of New York, by A. O. Jacobson, who has lately been doing some work on the Bay City tunnel level. Mine comprises six claims covering about 60 acres and was famous producer. Not known whom Mr. Belser represents.

Summit County

PARK CITY SHIPMENTS for June were: Silver King Coalition, 54 cars; Ontario, 30; Ontario Federal Leasing, 12; Judge, 44; Silver King Consolidated, 20; Daly-West, 23; Daly, 4; New Quincy, 3; American Flag, 2; Daly-West Quincy Lease, 2; Western Ore Purchasing Co., 3; Charles Moore, 1; E. J. Beggs, 2; Park City Mines, 2; Broadwater Mills, 4; total, 206 cars, or 8,589 tons.

VERMONT

Orange County

VERMONT COPPER CO. (South Strafford)—This company is arranging to resume smelting operations on 300-ton basis, following preliminary tests by George A. Guess. About 30 men working. New York office, 576 Fifth Avenue.

CANADA

Ontario

CROESUS (Munro Township)—A 2-ft. vein encountered in shaft at 400 ft.

DOME LAKE (Porcupine)—Orebody cut on 300-ft. level, proved for 150 ft.

QUAKER CITY (Cobalt)—The 200-ft. shaft unwatered and will be put down farther.

DOME EXTENSION (Porcupine)—Diamond-drill hole 300 ft. east of Dome property has cut 75-ft. vein.

ADANAC (Cobalt)—Native silver opened in vein at 315 ft., west winze. Vein runs up to 14 in. in width.

RED JACKET (Cobalt)—Homer Gibson and associates working this property on lease; William Hatch, in charge.

DOME (Porcupine)—Yield for June was $179,000 from 36,700 tons of ore; average yield $4.88 per ton; cost $2.62.

WRIGHT-HARGRAVES (Kirkland Lake)—Operations resumed; two surface veins containing visible gold and tellurides.

McKINLEY-DARRAGH (Cobalt)—Crosscutting at 400-ft. level to pick up veins encountered on the 200. Upper levels showing better than expected.

TOUGH OAKES (Kirkland Lake)—Shipments between $80,000 to $100,000 per month. Mill treating about 125 tons per day, 21 drills running, but only one of the compressors; not more than 800 hp. available.

GATINEAU ZINC (Burbidge Station)—New deposits of zinc ore discovered on this location; original find was made last fall by J. D. McFarlane and Dennis Callahan. Vein trenched across at intervals of 1,400 ft. showing ore from 6 to 15 ft. wide in places.

COLOMBIA

PATO MINES, LTD. (Zaragoza)—Rich cleanups obtained by dredge in June. For 15 days ended June 22, dredge dug 68,465 cu.yd. yielding $96,494, or about $1.40 per cu.yd.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—June cleanup, $128,600. Details of May cleanup: Tabowie mill bullion, $26,348; Taracol, $28,263; Maibong, $22,985; Taracol cyanide bullion, $51,586; Maibong tube-mill bullion, $3,800; total, $132,983; tons milled, 27,164.

The Market Report

Metal Markets

NEW YORK—July 12

All of the principal markets during the last week exhibited a continuance of the reactionary tendency. The statistical position of both copper and lead is good, that of spelter is not so good, but in all cases there is an absence of buyers.

Copper, Tin, Lead and Zinc

Copper—Scarcely any business was done, but copper was freely offered in large quantities by several first hands who were seeking to find a level at which buyers would be interested. The principal producers continued out of touch with the market, their output being entirely sold out far ahead, probably to Oct. 1 on the average. Indeed, they are finding it difficult to ship copper rapidly enough to fill their contracts. Other interests that are not so well sold offer liberally for deliveries beginning with September, and others will supply August copper on contracts coupled with September and October, without difference as to price, although for August copper alone a premium would be asked.

The market declined from day to day on free offerings, without developing business. Domestic consuming interests intimated that they might be buyers of large quantities at 23c., r. t., but they refused to make firm bids and no seller cared to go so low. There is also much reason to believe that there is a latent buying power from abroad, which will be exercised as soon as terms become attractive.

Visible Stocks of Copper in Europe on June 30: Great Britain, 4,218; France, 3,385; afloat from Chile, 2,225; afloat from Australia, 4,000; total, 13,828 long tons, or 30,974,720 lb. This is an increase of 1,569 tons over June 15, and of 146 tons over the May 31 report.

Tin—This market was very quiet, buyers holding back. The market declined a little in sympathy with London and in the absence of buying interest here.

Visible Stocks of Tin on June 30, including tin afloat: London, 8,786; Banka and Billiton, 4,040; United States, excluding Pacific ports, 6,537; total, 19,363 long tons. This is a decrease of 254 tons from May 31, but an increase of 3,406 tons over June 30 of last year.

Lead—Following the reduction by the A. S. & R. Co. late Wednesday afternoon, a rather large business was done, but from the outset the new price of the A. S. & R. Co. was cut by independent producers, even as much as $3 per ton. Producers who were sellers of lead at 6.40c., New York, right through the week steadily failed to get business. In the last half of the week the demand flattened out materially, and the sales reported on Tuesday and Wednesday were relatively small. At the close there were sellers at 6.35c., New York.

The St. Louis market declined in about the same way as New York. Sales of lead on the Pacific Coast were made at 6½c., for export.

Spelter—The decline continued from day to day, but early in the week the point was reached at which buyers were interested, and from that time on sales were much larger than in the previous week. To a considerable extent the purchases were short-covering, including buying-in by smelters who had previously sold ahead and had been delayed in making their expected new production, but there was also some buying by domestic consumers. Europe made bids for spelter at a little below the market. There is reason to believe that there is a considerable buying power that will be exercised at a level not much below the present.

At the close spot and July spelter was quoted at 8¼c., August at 8@8¼, September at 7¾@8c. Contracts running far ahead were made at considerably lower figures, business covering the last quarter being reported done on July 8 and 10 at 7½@8c., but at the close spelter for delivery in the last quarter could be bought more cheaply. Brass special was quoted at 9½@10c., intermediate—99¾% Zn—at 13c., and high-grade at 15@17c., all for July shipment.

Zinc Sheets are easier; on July 6, the base price was reduced 1c. per lb. to $17 per 100 lb. On July 11 there was a further reduction of 2c., and the base price is now $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—July 12

Aluminum—The market is rather quiet and demand less active than it has been, while supplies seem better. Quotations are a little easier at 58@60c. per lb. for No. 1 ingots, New York.

Antimony—This market steadied a little and somewhat more business than in the previous week was reported, but the volume continued small. We quote 15½@16½c. for spot. None of the principal interests would quote on futurse.

Imports of Antimony into the United States for the four months ended Apr. 30 were: Antimony contents of ore, 2,894,-

DAILY PRICES OF METALS IN NEW YORK

July	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
			24		6.35	6.25	8.25
6	4.7569	63⅛	@24½	39⅛	@6.50	@6.37½	@8.75
			23¾		6.35	6.20	8.25
7	4.7575	62⅛	@24⅛	39½	@6.50	@6.30	@8.75
			23¾		6.35	6.20	8.00
8	4.7575	62	@24	39½	@6.50	@6.30	@8.50
			23½		6.35	6.20	8.00
10	4.7575	60	@23⅞	38⅛	@6.50	@6.30	@8.50
			23½		6.30	6.12½	8.00
11	4.7575	61	@23⅝	38⅛	@6.40	@6.25	@8.50
			23½		6.30	6.12½	7.87½
12	4.7569	61⅛	@23⅝	38⅛	6.40	6.25	@8.25

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

July	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
6	30½	97	95	130	27.68	173	173½	28½	6.01	46½	9.90
7	29 11/16	91	89	129	27.47	173	173½	28	5.96	44	9.37
8	29⅝	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	28⅝	84⅛	82⅛	128	27.25	170	170⅛	28	5.96	44	9.37
11	29⅛	88	86	128	27.25	168½	169	28	5.96	44	9.37
12	29⅛	93	91	128	27.25	169½	170	28	5.96	45	9.58

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

932 lb.; metal and regulus, 6,523,673 lb.; total, 9,418,605 lb., an increase of 3,177,074 lb. over the corresponding period last year.

Quicksilver—The price in London advanced £1 to £17½, which stiffened the market here, but producers and dealers found it difficult to effect sales. We quote $80@83. San Francisco reports by telegraph $80, market quiet.

Nickel—There is no change, demand for domestic use being about as usual, with some inquiries for export. Quotations are 45@50c. per lb. for ordinary forms, according to size and terms of order. Electrolytic nickel brings 5c. per lb. premium.

Minor Metals—Current quotations for Bismuth are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium,** electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is lower, with sales at $3.50@3.75 per lb. for 99% pure.—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—July 12

Gold—The movement of gold from England direct and through Canada has come to a pause for the present, and only one small lot is reported this week.

Platinum—At the beginning of the week the price was $65 per oz. On Friday sales were made at $63 and today at about $60. We quote $62½ as the average for the week.

Silver—The market has experienced sharp fluctuations this week, falling from 30¼d. to 28⅝d., and reacting again to 29½d. The break in price has been due to continued selling by China and liquidation of tired bulls. The stock in London continues large, about £1,200,000, with comparatively small demand, as coinage demand from France and the Continent has ceased for the present. Market closes firmer on cessation of liquidation and selling by China.

Messrs. Samuel Montague & Co., London, write under date of June 22: "Following are the imports and exports in Great Britain of refined silver for the first five months of 1915 and 1916, in ounces:

	1915	1916	Changes
Imports	39,275,640	37,502,989	D. 1,772,651
Exports	32,518,465	20,563,249	D. 11,955,216
Net imports	6,757,175	16,939,740	D. 10,182,565

It will be observed that the imports closely approximate for each period, but the exports show a remarkable falling-off of about 37%. This decrease is more than covered by a reduction of nearly 16,000,000 oz. in the shipments to British India. The disposal of the unshipped balance shows how importantly the Home Mint has figured as a buyer during the present year."

Mexican Dollars on July 6 were quoted in New York at 48¾@51¾c.; July 7 at 48⅛@51⅛c,. July 8 at 47⅝@50⅝c.; July 10 at 46⅛@49⅛c., July 11 at 46⅞@49⅞c.; July 12 at 46¾@49¾c.; a net drop of 2c. during the week.

Zinc and Lead Ore Markets

JOPLIN, MO.—July 8

Blende, high price $83.17; per ton 60% zinc, premium ore, $80; medium, $75@65; down to $55 low; calamine, per ton 40% zinc, $55@45; average, all grades of zinc, $72.17 per ton. Lead, high price $79.80; base, $77.50@75 per ton 80% metal content; average selling price, all grades of lead, $76.20 per ton.

SHIPMENTS WEEK ENDED JULY 8

	Blende	Calamine	Lead	Values
Totals this week	11,374,870	954,890	1,858,010	$515,700
Totals this year.	371,391,880	29,812,060	63,582,530	22,932,500

Blende value, the week, $421,400; 27 weeks, $19,035,620.
Calamine value, the week, $23,510; 27 weeks, $1,057,230.
Lead value, the week, $70,790; 27 weeks, $2,839,650.

The continued decline in spelter has demoralized the small smelting companies, every one of which withdrew from the market this week indefinitely. One, the Henryetta, has a strike in full force. The others, making only 70% furnace recovery, as a result of the inefficiency produced by prosperity, will smelt the ore on hand and will then "dead fire" unless the situation in metal brightens. The production of zinc ores, which reached the zenith of 10,000 tons the last week of April, has declined to around 8,000 tons per week. Some of the "sheet ground" mines are now arranging to close down and further declines in metal and ore prices will force others to follow soon. It now seems evident the output will be reduced to around 6,500 tons per week by the end of the month.

PLATTEVILLE, WIS.—July 8

The base price paid this week for zinc ore was $67@68 per ton 60% zinc for top grades down to $62 per ton base for medium grades assaying down to 50% zinc. The base price paid for 80% lead ore was $75@77 per ton.

SHIPMENTS, WEEK ENDED JULY 8

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	5,100,000	178,830	825,800
Year	124,816,000	4,513,840	30,825,600

Shipped during week to separating plants, 5,976,000 lb. zinc ore. Zinc-ore shipments to smelteries gained 21,436,020 lb., lead-ore shipments gained 838,120 lb. and sulphur-ore shipments gained 16,213,910 lb., as compared with the first six months of 1915.

OTHER ORES

Manganese Ore continues to bring a high price. Quotations are about 75@85c. per unit for 50% Brazilian ore. Notwithstanding the demand for manganese ores the production in the United States in 1915 is reported by the Geological Survey at only 9,569 tons.

Local prospectors report the discovery of a large outcrop of manganese ore at Lower Shebandowan Lake in the Thunder Bay district in Ontario. Further exploration is needed to determine its extent and value.

Tungsten Ore—The ideas of buyers and sellers were very far apart. Business was reported done at figures close to $20 per unit, but we were unable to verify those reports. A broker in trying to buy to fill orders was unable to persuade sellers to let go at less than $30, at which price no business could be done. The market is probably in the neighborhood of $25 per unit.

Antimony Ore—The market for this ore is dead and no quotations are made.

Bismuth Ore—We have had inquiries respecting market value of bismuth ore. There are no quotations for this ore, and no general market for it in this country. Ore might be salable if producer would make a firm offer as to quantity and date of shipment. Price would be a matter of private negotiation.

Iron Trade Review

NEW YORK—July 12

Domestic orders continue quiet, but export business is active and several large orders have been placed for rails, wire and shell steel.

For home use there is a demand for plates for ship and car work, and for bars, though the usual July contracts for bars have not been placed yet.

The pig-iron market continues rather quiet though there has been some demand for bessemer pig for export, and for basic iron from the steel mills. Some large transactions in scrap for steel making are reported, and that class of material has been especially active in the Central West.

Exports of semi-finished steel—ingots, billets and blooms—from the United States in April were 88,764 gross tons; in the four months ended Apr. 30 they were 339,081 tons, against 99,480 tons in the corresponding months of 1915; an increase of 239,601 tons, or 248.5% this year.

The sale of the Pennsylvania Steel Co. and its subsidiaries to the Bethlehem Steel Co. has been completed, the United States Circuit Court of Appeals having thrown out the suit to enjoin the transfer brought by C. H. Venner, of New York.

The United States Steel Corporation reports the total unfilled orders on its books June 30 at 9,640,450 tons of material; a decrease of 297,340 tons from May 31. This is the first decline in unfilled orders since August of last year.

Pig Iron Production in June showed a slight decrease. The reports of the blast furnaces, as collected and published by the "Iron Age" show that on July 1 there were 323 coke and anthracite stacks in blast, having a total daily production of 107,800 tons, being 600 tons less than on June 1. Making allowance for the charcoal furnaces the total make of pig iron in June was 3,247,000 gross tons; for the six months ended June 30 it was 19,611,800 tons. Of this total 13,821,000 tons, or 74.7%, was made by the furnaces owned or operated by the steel companies. The effect of heavy driving for many months, besides that of hot weather, is beginning to show at the furnaces.

A syndicate known as the Sindicato Petrolifero del Oriente Boliviano has been formed by Chilean capitalists to exploit an area of 545,000 hectares (1,345,150 acres) of oil-bearing lands in eastern Bolivia. To carry on the work of exploitation as planned, subscriptions for approximately $10,000,000 are to be raised, chiefly from the nitrate producers in the north of Chile who are desirous of securing an independent and economical source of fuel.

Iron Production in Alabama in June is reported at 204,389 gross tons. For the six months ended June 30 the total make was 854,353 tons in 1915, and 1,367,066 tons in 1916; an increase of 512,713 tons, or 60%, this year. The make of basic pig in the Birmingham district was 67,712 tons in June and 427,819 tons for the half-year. This is the best record made for a half year in this district.

Steel Production, Ingots and Direct Castings, in the United States in 1915 is reported by the Statistical Bureau of the American Iron and Steel Association as follows: Basic openhearth, 22,308,725; acid openhearth, 1,370,377; bessemer, 8,287,213; crucible, 113,782; electric, 69,412; miscellaneous, 1,527; total, 32,151,036 gross tons, being 8,638,006 tons more than in 1914, and 850,162 tons more than in 1913. The total production of rolled iron and steel was 24,392,924 gross tons.

PITTSBURGH—July 11

Record hot weather for the season developed today and steel-mill outputs are materially reduced. In pig iron there was a reduction even in June. Steel consumption, it is believed in steel-making circles, is not being decreased by weather conditions as much as production.

The steel market is extremely quiet, and the decided decline in activity which began about the first of June has now culminated in a practically stagnant market. The Steel Corporation's unfilled obligations decreased 297,340 tons, following continued increases for nine months, but there had been those who predicted a decrease even in May. Of more importance than the June decrease in total obligations is the recent statement of Chairman Gary that the Corporation has about 6,000,000 tons in actual specifications, that being an extremely large tonnage for the corporation subsidiaries to have booked in the form of actual shipping orders. The large independents are as a rule in substantially the same position, and no one considers it among the possibilities for the large interests to make any effort to book orders by offering concessions for many months, unless perhaps forced to do so by the smaller mills making cuts, just as heretofore they have been demanding premiums for the earlier deliveries they could make. It is generally held that the steel market will not be affected by two months more of dullness like that of the present, while it is believed that sufficient new buying will develop by September to maintain the mill position comfortably through the year.

Premiums for early deliveries have practically disappeared, except on plates, and on plates there are smaller premiums than formerly, prompt deliveries being generally obtainable at about 3.50c., against the base price of 2.90c., Pittsburgh.

Pig Iron—The market continues very dull. Some recent reports of sales of basic iron prove to be fabrications, apparently made for the purpose of arousing the interest of buyers. There is continued demand from abroad for bessemer iron, the price of which is easily maintained and despite the $3 spread of bessemer above basic it is thought in some quarters that there may be a further advance as the tonnage of bessemer ore obtainable is somewhat limited. We quote: Bessemer, $21@21.50; basic, $18; foundry and malleable, $18.25@18.50; forge, $18@18.25, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—Billets and sheet bars continue strong, the market having fully recovered from the flurry of a few weeks ago. There is little domestic demand, but sufficient export demand to absorb all offerings and maintain prices. We quote soft steel billets and sheet bars at $42@43 for bessemer and $44@45 for openhearth, with rods at $55@60, and high-carbon rods $70@80 per ton.

FOREIGN IRON

The iron-ore deposits of the Telbess Basin, near Kuznetsk, in Siberia, were conceded to the Kuznetsk Coal Mines Co. in 1913, and a careful examination was begun. The report recently submitted shows 27,000,000 tons of iron ore so far blocked out and surveyed. The main deposit is on the bank of the Telbess River. It can be easily mined and is near the coal deposits of Kuznetsk. The company prposes to establish extensive iron works.

FERROALLOYS

Spiegeleisen is rather easier as supplies seem more plentiful. Quotations for ordinary 20% spiegel are $45@50 per ton at furnace. Higher grade, 30%, brings $50@55 per ton.

Ferrosilicon, high grade, 50% alloy is $83@85 per ton at mill. We do not hear of any premiums being paid. Lower grade, bessemer ferrosilicon, is from $33 per ton for 10% up to $43 for 16%, at mill.

Ferrotungsten—This alloy for export sale must assay 75% and upward in tungsten and not over 1.25% carbon and 0.05% sulphur. Present value of such metal is 5@6c. per lb. of tungsten content. Alloy with 4% carbon is offered, but there is no market for such, either domestic or foreign.

Ferromanganese—The market has softened farther, prompt being $200@225 as far as it can be quoted with demand so very light, while contract at the regular price of $175 can be had for earlier deliveries than formerly. Deliveries on contracts are reported better than for months.

Reactol—The London correspondent of the "Iron Age" writes as follows of a new high-speed tool steel: "A new steel alloy known as Reactol, and produced at Sheffield, is arousing a good deal of interest in England among makers of high-speed tool steel. It is said that it contains neither tungsten nor cobalt, and that it requires neither forging, hardening nor tempering, but merely has to be ground into shape in order to make it ready for work of the heaviest character. Very high service claims are made for it."

IRON ORE

Ore shipments from the Lake Superior region in June were 9,507,576 long tons, being 1,057,996 tons more than in May. For the season to July 1 the total shipments are reported by the "Iron Trade Review" as below, in long tons:

Port.	1915	1916	Changes
Escanaba	1,248,830	2,602,824	I. 1,353,994
Marquette	547,002	1,154,140	I. 607,138
Ashland	1,161,792	2,204,263	I. 1,042,471
Superior	1,777,600	3,878,915	I. 2,101,315
Duluth	4,295,811	6,325,990	I. 2,030,179
Two Harbors	2,490,248	3,449,435	I. 959,187
Total	11,521,283	19,615,567	I. 8,094,284

The total increase this year was 70.3%. The labor troubles on the Mesabi have not interfered with shipments so far. The June movement was the largest ever reported in one month.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 423,550 net tons; shipments, 437,016 tons. Shipments of Greensburg and Upper Connellsville districts, 37,361 tons.

The United States Geological Survey estimates the production of bituminous coal in the United States in the first half of 1916 at 261,000,000 tons.

Connellsville—Hot weather is interfering with production, as the men are doing less work and ovens are frequently drawn a day or two late. Following a week with a holiday in it, the condition makes supplies limited and spot coke is higher, while any real buying would probably cause a further advance. Contract coke is not in demand. We quote: Spot furnace, $2.65@2.75; contract, $2.30@2.50; spot foundry, $3@3.25; contract foundry, $3.25@3.50, per net ton at ovens.

Chemicals

NEW YORK—July 12

The general market is again quiet and rather inactive. Prices are not strong and heavy chemicals are moving rather slowly.

Arsenic—Supplies are not heavy, but demand is light also; prices are a little easier and sales are reported at $6@6.25 per 100 lb. for early delivery.

Copper Sulphate—Consumers seem rather conservative, and buyers are not active even at the recent decline. Business has been rather small. Quotations are still lower at $9@10 per 100 lb. for large lots for early delivery.

Nitrate of Soda—The market is quiet and there is no pressure either to buy or sell. The reported large stocks on the West Coast do not seem to affect the market, and ocean freights remain very high. Quotations show no material change, $3.10@3.15 per 100 lb. being asked for spot; $3.05@3.10 for August and later delivery. Production in Chile in May reached a total of 243,360 tons, as against 107,000 tons for the corresponding period last year. This makes total production for the first five months of the year 1,231,019 tons, as against 487,957 tons in 1915.

Sulphur—Demand continues good and prices firm. The cost of transportation still helps to keep up quotations, which are $35 per long ton, New York, for spot, and $30 for futures.

Sulphuric Acid—The market is rather easier, and 60-deg. acid is now quoted at $20 per ton; while 66-deg. acid is $35 per ton for early shipment.

PETROLEUM

Exports of mineral oils from the United States in May are reported by the Department of Commerce at 228,478,733 gal., an increase of 2,527,035 gal. over May, 1915. For the five months ended May 31 the total exports were 860,726,752 gal. in 1915, and 953,903,651 gal. in 1916; an increase of 93,176,899 gal., or 10.8%, this year.

Mexican oil imports into the United States in May were 1,806,318 bbl., an increase of 186,766 bbl. over April.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Mont.	June 15	July 15	$0.005
Algomah, Mich.	May 18	.....	1.00
American, Utah.	June 18	July 20	0.001
Blue Bell, Ida.	July 8	Aug. 5	0.002
Bullion, Ida.	July 10	July 31	0.01
Cedar Creek, Ida.	July 5	Aug. 5	0.01
Central Eureka, Calif.	June 16	July 14	0.05
Columbus Ext., Utah.	July 13	Aug. 8	0.02
Confidence, Nev.	June 23	July 14	0.10
Cons. Imperial, Nev.	July 18	Aug. 10	0.01
Crackerjack, Nev.	July 3	Aug. 1	0.01
Friend, Ida.	June 30	July 20	0.002
Giant, Ida.	June 16	July 17	0.003
Goldstrike Bon., Utah.	June 15	July 15	0.01
Gold Mt. Champion, Utah.	July 20	Aug. 10	0.0025
Gould & Curry, Nev.	July 14	Aug. 3	0.03
Great Western, Nev.	July 24	Aug. 15	0.005
Hope, Calif.	July 17	Aug. 14	0.01
Hugo, Ida.	July 29	Aug. 30	0.002
Independence, Ida.	July 8	July 29	0.001
Laclede, Ida.	July 3	July 25	0.003
Lucky Calumet, Ida.	July 20	Aug. 21	0.005
Morgan Argentine, Utah.	July 15	Aug. 5	0.01
Nevada-Douglas, Nev.	July 15	Aug. 16	0.10
North Lake, Mich.	June 14	.....	1.00
Old Veteran, Ida.	July 8	Aug. 5	0.002
Rio Grande, Nev.	June 22	July 22	0.002
Rockford, Ida.	June 30	July 21	0.002
Sierra Nevada, Nev.	July 11	Aug. 3	0.10
Silver Moon, Ida.	July 8	Aug. 3	0.005
Silver Pick, Nev.	July 5	Aug. 14	0.01
Southern Swansea, Utah.	July 17	Aug. 5	0.001
Spearhead Reor., Nev.	July 3	Aug. 3	0.01
Swansea Ext., Utah.	July 10	Aug. 1	0.0025
Tar Baby, Utah.	Aug. 3	Sept. 4	0.01
Tarbox, Mont.	July 25	Aug. 12	0.005
Tintic Central, Utah.	July 12	Aug. 8	0.005
Ton. Gypsy Queen, Nev.	July 11	Aug. 15	0.01
Uvada, Nev.	June 24	July 27	0.02
Victoria, Utah.	July 8	Aug. 2	0.005
Wallace, Ida.	June 29	July 29	0.0025
Wasatch-Utah, Utah.	June 19	July 22	0.0025
West Mercur, Utah.	July 8	July 31	0.025

Stock Quotations

SAN FRANCISCO July 11	
Name of Comp.	Bid.
Alta.	.05
Andes.	.11
Best & Belcher.	.05
Bullion.	.04
Caledonia.	‡.44
Challenge Con.	.04
Confidence.	.18
Cons. Imperial.	.01
Con. Virginia.	.10
Gould & Curry.	.03
Hale & Norcross.	.07
Jacket-Cr. Pt.	.02
Mexican.	.15
Occidental.	.70
Ophir.	.28
Overman.	.06
Savage.	‡.07
Seg Belcher.	.02
Sierra Nevada.	.22
Union Con.	.71
Utah Con.	.01
Belmont.	4.15
Jim Butler.	.94
MacNamara.	.05
Midway.	.17
Mont.-Tonopah.	.23
North Star.	.13
Rescue Eula.	.27
West End Con.	.93
Atlanta.	.10
Blue Bell.	‡.01
Booth.	.15
C.O.D. Con.	.03
Comb. Frac.	.06
D'field B.B.	.02
D'field Daisy.	.02
Jumbo Extension.	.77
Pitts.-Silver Peak.	.08
Round Mountain.	.41
Sandstorm Kendall.	.03
Silver Pick.	.10
Central Eureka.	.10
Argo.	.12
Ariz. Central.	.10
Big Jim.	.75
Lazy Boy.	.12
Oatman No. Star.	‡.17
Tom Reed.	1.40
United Eastern.	3.50
United Western.	.12

LONDON June 27	
Alaska Tre'dwell	£5 15s 0d
Burma Corp.	3 4 4½
Cam & Motor.	0 14 3
Camp Bird.	0 8 9
El Oro.	0 9 0
Esperanza.	0 10 7½
Mexico Mines.	3 17 6
Nechi, pfd.	0 13 3
Oroville.	0 16 0
Santa Gert'dis.	0 12 3
Tomboy.	1 2 6

SALT LAKE July 11	
Name of Comp.	Bid.
Alta Con.	.40
Black Jack.	.05
Colorado Mining.	.17
Crown Point.	.04½
Daly-Judge.	7.50
Emma Cop.	.40
Gold Chain.	.24
Grand Central.	.65
Iron Blossom.	1.67½
Lower Mammoth.	.04½
May Day.	.13
Opohongo.	‡.01¾
Prince Con.	1.37½
Seven Troughs.	.02
Silver King Coal'n.	2.90
Silver King Con.	3.20
Sioux Con.	.11
Uncle Sam.	.06½
Yankee.	.49

COLO. SPRINGS July 11	
Acacia.	.03½
Doctor Jack Pot.	.8½
Elkton Con.	.15
El Paso.	.78
Findlay.	.03½
Gold Sovereign.	.03½
Golden Cycle.	2.02½
Granite.	.67
Isabella.	.18
Jack Pot.	.05
Jerry Johnson.	.03½
Mary McKinney.	.30
Portland.	1.68
Vindicator.	2.15

TORONTO July 11	
Adanac.	1.81½
Bailey.	.06
Chambers Ferland.	.20
Coniagas.	4.50
La Rose.	.60
Peterson Lake.	.23
Right of Way.	.05½
Seneca Superior.	.37
T. & Hudson Bay.	50.00
Temiskaming.	.55
Trethewey.	‡.21
Wettlaufer-Lor.	.12
Dome Exten.	.25
Dome Lake.	.31½
Foley O'Brien.	.50
Hollinger.	29.30
Imperial.	‡.03
Jupiter.	.31
McIntyre.	1.50
Porcu. Crown.	.75
Preston E. D.	‡.03
Vipond.	.45
West Dome.	.36

N. Y. EXCH. July 11	
Name of Comp.	Clg.
Alaska Gold M.	18½
Alaska Juneau.	8
Am.Sm.&Ref.,com.	92
Am. Sm. & Ref., pf.	110½
Am. Sm. Sec., pf. A	91½
Am. Sm. Sec., pf. B.	83½
Am. Zinc.	29½
Am. Zinc, pf.	60½
Anaconda.	79
Batopilas Min.	1½
Bethlehem Steel.	443
Bethlehem Steel, pf.	125½
Butte & Superior.	62
Chile Cop.	20
Chino.	46½
Colo. Fuel & Iron.	42½
Crucible Steel.	73½
Dome Mines.	25½
Federal M. & S.	12½
Federal M. & S., pf.	38
Great Nor., ore ctf.	35½
Greene Cananea.	44
Homestake.	130½
Inspiration Con.	50¾
International Nickel	45½
Kennecott.	45½
Lackawanna Steel.	63½
Miami Copper.	33½
Nat'l Lead, com.	63½
National Lead, pf.	113
Nev. Consol.	16
Ontario Min.	6¾
Quicksilver.	2½
Quicksilver, pf.	4½
Ray Con.	21½
Republic I&S, com.	44
Republic I&S, pf.	108
Sloss-Sheffield.	45
Sloss-Sheffield, pf.	94
Tennessee Copper.	31
Utah Copper.	75½
U. S. Steel, com.	84½
U. S. Steel, pf.	117½
Va. Iron C. & C.	44

N. Y. CURB July 11	
Beaver Con.	.37
Buffalo Mines.	1
Butte & N. Y.	1½
Butte C. & Z.	5½
Can. Cop. Corpn.	.1¾
Cashboy.	.05
Cerro de Pasco.	33
Con. Ariz. Sm.	1¹⁵⁄₁₆
Con. Coppermines.	2½
Con. Nev.-Utah.	‡.28¾
Crystal Cop.	1
First Nat. Cop.	3½
Florence.	.41
Goldfield Con.	.85
Goldfield Merger.	.09½
Granite.	.28
Hecla Min.	.5½
Howe Sound	4½
Jerome Verde.	1¾
Joplin Ore & Spel.	2½
Kenefick Zinc.	‡13½
Kerr Lake.	.6½
Magma.	13½
Majestic.	.68
McKinley-Dar-Sa.	.52
Mother Lode.	.27
Nevada Hills.	.18
N. Y. & Hond.	16½
Nipissing Mines.	6¾
Oro.	‡.05
Ray Hercules.	3½
Rochester Mines.	.57
St. Joseph Lead.	15½
Standard S. L.	1¾
Stewart.	.25
Success.	.69
Tonopah.	6
Tonopah Ex.	5⅛
Tribullion.	¾
United Zinc.	6¼
White Knob, pf.	1½
Yukon Gold.	2

BOSTON EXCH July 11	
Name of Comp.	Bid
Adventure.	2½
Ahmeek.	90
Algomah.	1½
Allouez.	59
Ariz. Com., ctfs.	8½
Bonanza.	.25
Butte-Balaklava.	2
Calumet & Ariz.	66
Calumet & Hecla.	520
Centennial.	14
Copper Range.	55
Daly West.	2
East Butte.	11½
Franklin.	6½
Granby.	80
Hancock.	12
Helvetia.	.25
Indiana.	2
Island Cr'k, com.	45½
Island Cr'k, pfd.	88½
Isle Royale.	25
Keweenaw.	3½
Lake.	10½
La Salle.	‡1
Mason Valley.	1½
Mass.	10½
Mayflower.	2
Michigan.	2½
Mohawk.	78½
New Arcadian.	4½
New Idria.	11½
North Butte.	21
North Lake.	1½
Ojibway.	1
Old Colony.	1½
Old Dominion.	61
Osceola.	80½
Quincy.	81
St. Mary's M. L.	‡74½
Santa Fe.	1½
Shannon.	8
Shattuck-Ariz.	24½
So. Lake.	4½
So. Utah.	.15
Superior.	13½
Superior & Bost.	3½
Tamarack.	38
Trinity.	42
Tuolumne.	.30
U. S. Smelting.	66½
U. S. Smelt'g, pf.	50
Utah Apex.	4½
Utah Con	12½
Utah Metal.	7
Victoria.	2½
Winona.	4½
Wolverine.	50
Wyandot.	1½

BOSTON CURB July 11	
Bingham Mines.	10½
Boston Ely.	.95
Boston & Mont.	.70
Butte & Lon'n Dev	.67
Calaveras.	4½
Calumet-Corbin.	.03
Chief Con.	1¾
Cortez.	.35
Crown Reserve.	.50
Davis-Daly	1½
Eagle & Blue Bell	1¾
Houghton Copper.	1½
Iron Cap Cop., pf.	6
Mexican Metals.	.33
Mines of America.	2½
Mojave Tungsten.	5
Nat. Zinc & Lead.	1½
Nevada-Douglas.	1
New Baltic.	1¾
New Cornelia.	12½
Ohio Copper.	.10
Oneco.	1
Raven Copper.	‡.18
Rex Cons.	.16
Rilla.	.21
United Verde Ext.	27½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January.	56.572	48.855	56.775	26.553	22.731	26.960
February.	57.506	48.477	56.755	26.573	22.753	26.975
March.	58.067	50.241	57.935	26.788	23.708	27.597
April.	58.519	50.250	64.415	26.958	23.709	30.662
May.	58.175	49.915	74.269	26.704	23.570	35.477
June.	56.471	49.034	65.024	25.948	23.267	31.060
July.	54.678	47.519	.....	25.219	22.597	.....
August.	54.344	47.163	.....	25.979	22.780	.....
September.	53.200	48.680	.....	24.260	23.591	.....
October.	50.654	49.385	.....	23.199	23.925	.....
November.	49.082	51.714	.....	22.703	25.094	.....
December.	49.375	54.971	.....	22.900	26.373	.....
Year.	54.811	49.634	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April.	16.811	27.895	75.096	124.319	*	137.389
May.	18.506	28.625	77.600	135.457	*	152.522
June.	19.477	26.601	82.574	112.432	95.333	137.455
July.	18.796	.....	76.011	.....	91.409	.....
Aug.	16.941	.....	68.673	.....	82.333	.....
Sept.	17.502	.....	68.915	.....	85.250	.....
Oct.	17.686	.....	72.601	.....	88.000	.....
Nov.	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.43	.....
Year.	17.275	.....	72.532	.....	.....	.....

TIN

Month	New York		London	
	1915	1916	1915	1916
January.	34.260	41.825	156.550	175.548
February.	37.415	42.717	176.925	181.107
March.	48.426	50.741	180.141	193.609
April.	47.884	51.230	166.225	199.736
May.	38.790	49.125	162.675	196.511
June.	40.288	42.231	167.636	179.466
July.	37.423	.....	167.080	.....
August.	34.389	.....	151.440	.....
September.	33.125	.....	152.625	.....
October.	33.080	.....	151.554	.....
November.	39.224	.....	167.670	.....
December.	38.779	.....	167.000	.....
Av. year.	38.590	.....	163.960	.....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January.	3.729	5.921	3.548	5.826	18.606	31.167
February.	3.827	6.246	3.718	6.164	19.122	31.988
March.	4.053	7.136	3.997	7.375	21.883	34.440
April.	4.221	7.630	4.142	7.655	21.094	34.368
May.	4.274	7.463	4.182	7.332	20.347	32.967
June.	5.932	6.936	5.836	6.749	25.170	31.071
July.	5.659	.....	5.531	.....	24.611	.....
August.	4.656	.....	4.520	.....	21.946	.....
September.	4.610	.....	4.490	.....	23.151	.....
October.	4.600	.....	4.499	.....	23.994	.....
November.	5.155	.....	5.078	.....	26.278	.....
December.	5.355	.....	5.266	.....	28.807	.....
Year.	4.673	.....	4 5 7	.....	22.917	.....

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April.	10.012	16.695	9 837	16.525	49.888	99.056
May.	14.781	14.276	14.610	14.106	68.100	94.217
June.	21.208	11.752	21.038	11 582	100.614	68.591
July.	19.026	.....	18.856	.....	97.250	.....
Aug.	12.781	.....	12.611	.....	67.786	.....
Sept.	13.440	.....	13.270	.....	67.841	.....
Oct.	12.800	.....	12.596	.....	66.536	.....
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year.	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January.	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February.	14.55	21.16	13.45	18.93	13.90	19.51
March.	14.55	21.81	13.45	19.20	13.95	19.45
April.	14.55	21.65	13.45	18.95	13.95	19.45
May.	14.61	21.78	13.60	19.11	13.83	19.58
June.	14.70	21.95	13.67	18.95	13.77	19.34
July.	14.94	.....	13.91	.....	13.68	.....
August.	16.01	.....	15.31	.....	14.75	.....
September.	16.86	.....	15.95	.....	15.70	.....
October.	16.95	.....	15.96	.....	15.80	.....
November.	17 57	.....	16.47	.....	17.20	.....
December.	19.97	.....	18.44	.....	18.95	.....
Year.	$15.82	.....	$14.76	.....	$14.95	.....

‡As reported by W. P. Snyder & Co.